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WIND-DRIVEN INERTIAL OSCILLATIONS WITHIN QUEEN CHARLOTTE SOUND AND HECATE STRAIT, MAY - SEPTEMBER 1977

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ABSTRACT

Inertial oscillations in current records collected from May to September, 1977, at ten mooring sites 20-300 km apart in the Queen Charlotte Sound-Hecate Strait region of northwestern British Columbia are analyzed. Near-surface oscillations were wind-driven, clockwise rotary and circularly polarized; near-bottom oscillations at depths of 155-330 m were clockwise rotary, less than 10% of near-surface amplitudes, highly elliptical and poorly correlated with surface winds. In the open southwest sector of the region, near-surface spectra possessed well-defined peaks centered roughly 3.5% above the local inertial frequency (f), whereas spectra for the semi-enclosed northern sector had broad peaks centered at f. The peak spectral frequency at the southeast corner of the mooring array was 6.5% below f and is linked to a Doppler shift by mean flow advection of comparatively high wavenumber inertial oscillations. Spectral amplitudes decreased eastward and northward over the sea in concert with decreases in intensity and degree of veering of traveling frontal-type winds. The latter appear to have been due in part to modification of the winds by the coastal topography. A particularly vigorous wind-generated surface "event" in mid-June was coherent to 99% confidence over a distance of 300 km, attained maximum speeds of approximately 75 cm s^{-1} and persisted for more than 8 days at most locations and 11 days at a mooring at the edge of the continental shelf. (Typical durations for single wave groups were $\sim 2\frac{1}{2}$ days.) This event, together with a similar less energetic event in August, is linked to quasi-resonant forcing by frontal winds associated with sequences of regularly spaced, eastward traveling extratropical cyclones. Current ellipse orientations and the time lags for the onset of inertial oscillations for these events were consistent with the directions and propagation speeds of cyclonic winds over the coast. Estimated wavelengths ranged from 300-700 km over the main portion of the sea to 85-95 km in the southeast corner. Lastly, the start times of major wind-forced events coincided with sharp attenuation of salinity and temperature fluctuations recorded by the near-surface current meters and indicate a deepening of the wind mixed layer by inertial current-induced vertical shears.

1. INTRODUCTION

Current fluctuations of near-inertial frequencies are commonly observed features of the world's oceans. Although detectable at depth in the oceanic interior (Webster, 1968; Fu, 1980), these inertial wave motions are invariably strongest within the near-surface layer where they are primarily generated by mesoscale winds (e.g. Pollard, 1970; Gonella, 1971; Kundu, 1976) and geostrophic adjustment of mesoscale currents (e.g. Blumen, 1972; Tang, 1979). Wind-generated inertial oscillations, in particular, constitute one of the more energetic frequency bands within the upper ocean.

The principal characteristics of near-surface inertial motions in the open ocean are well documented (Kroll, 1975; Kundu, 1976; Pollard, 1980). Observations reveal highly intermittent, initially strong currents with typical maximum speeds of 10 to 20 cm s^{-1} that undergo rapid attenuation within a few cycles. The horizontal velocity vector is nearly circularly polarized and rotates clockwise (looking downward) in the northern hemisphere. Rotation periods are usually a few percent less than the local inertial period. Phase propagation is vertically upward and is accompanied by a downward flux of kinetic energy, consistent with a near-surface generation mechanism. Coherence scales for upper layer motions vary from tens of metres in the vertical to tens of kilometres in the horizontal with a tendency for horizontal coherences to diminish rapidly with depth. Where the Brunt-Väisälä frequency, N(z), is a slowly varying function of depth, as beneath the surface pycnocline, the horizontal velocity components are roughly proportional to $N^{\frac{1}{2}}$, in agreement with the approximate WKB solutions to the linear inertial wave equations.

In this report, we present an analysis of near-surface and near-bottom inertial oscillations observed within the semi-enclosed coastal sea that separates the Queen Charlotte Islands from Vancouver Island and the mainland of British Columbia (Fig. 1). Current meter records are from ten mooring sites in both exposed and protected regions of the sea and span two deployment periods from May to September, 1977. A combination of harmonic analysis and bandpass filtering has been used to isolate motions within the inertial frequency band from the comparatively strong ($\sim$25 cm s^{-1}) tidal currents within the region (e.g. Huggett et al, 1981). Because only single current meters were moored in the near-surface layer, the analysis concentrates primarily on the temporal and horizontal structures of the inertial wave fields. Many features of the inertial oscillations within the coastal sea resemble those obtained from previous oceanic observations. However, we also present findings which appear to be new to the literature. Particular attention is given near-surface inertial oscillations associated with two major summertime "events" which we show were highly coherent over hundreds of kilometres, attained maximum speeds in excess of 50 cm s^{-1}, and persisted longer than a week at most moorings. Results further indicate that current oscillations of subinertial frequencies were a common feature of the coastal sea, and were especially prevalent at a single near-surface mooring in the southeast region of Queen Charlotte Sound. Although the primary purpose of this paper is to report the major characteristics of the inertial currents within the coastal sea, an attempt has been made to account for the observations on the basis of present theoretical concepts. The generation of inertial oscillations is shown to have considerable practical importance to the circulation and mixing processes within the region.

Figure 1. Map of the region showing locations of current meter moorings (prefixes Q, H, CS) and wind stations (triangles). Moorings CS02 and CS02 are within Caamaño Sound and H02 within Browning Entrance. Dotted line is 100 fathom (183 m) contour. M - McInnes Island; B - Bonilla Island; S - Sandspit; E - Ethelda Bay.


Rose Pt.
54°
131° 45'
Kitimat
54°
128°
H02
H01
B
Banks
Island
BRITISH
COLUMBIA
S
Queen Charlotte Islands
100 fm
HECATE
STRAIT
E
CSO1
CSO2
CSO3
Prince
Royal
Island
Q07
Q08
M
52°
131° 45'
C. St. James
QUEEN
CHARLOTTE
SOUND
52°
128°
Q05
Q04
NORTHEAST
PACIFIC
OCEAN
Q03
Queen C.
Strait
C.
Scott
50 km
Sartine I.
Vancouver
Island

FIG 1

The report is organized as follows. Section 2 describes the data set and processing methods. In Section 3, the major features of the inertial oscillations are discussed on the basis of the component plots of winds and bandpass filtered currents. Section 4 is devoted to the spatial and temporal variability of near-surface spectral amplitudes, derived from different lengths of data, while Section 5 presents complex demodulations of the inertial signals using two separate analytical techniques. Spectral coherences for the major inertial events are presented in Section 6 together with the corresponding signal admittances. The variability of current ellipses at inertial frequencies is discussed in Section 7 and in Section 8 we account for the anomalously low frequencies at mooring Q04. Section 9 provides a discussion and summary.

2. DATA COLLECTION AND PROCESSING

The region

Queen Charlotte Sound and Hecate Strait comprise a coastal sea with an area of approximately 45×10^3 km^2, a maximum width normal to the outer coast of around 140 km and an axial length of 400 km (Fig. 1). Bathymetric charts of the seaway reveal a convoluted coastline of shoals and broken island groups bordering an inner continental shelf region cleaved by a series of re-entrant troughs. Within the southern portion of the sea, the troughs are separated by shallow ($\sim$100 m) banks; a major trough extends northward into Hecate Strait, another eastward into Queen Charlotte Strait.

The data set

The subsurface moorings spanned two deployment periods of approximately two months each from May to September, 1977 (Table 1). With the exception of the single-meter stations CS01, CS03 and H02, two Aanderaa RCM 4 current meters were deployed at each location with one meter at less than 25 m depth and the other at a fixed height of 4-5 m above the bottom. (A mooring south of Cape St. James was lost and there was no redeployment at Q05). The instruments recorded instantaneous direction, temperature and conductivity together with average speed at a sampling interval of 15 min. At all but one location (H01) the meters also recorded pressure or time, as obtained from an independent "time code generator" (marked "t" in the last column of Table 1).

Prior to analysis, the data were corrected for any timing errors, converted to speed and direction, plotted, then hand-edited to remove obvious 'spikes'. To facilitate use of available programs for determining the tidal current constituents, smoothed records of hourly values were generated by passing a weighted filter over the east-west and north-south velocity component records. Following filter compensation, the harmonic constituents were calculated along with inferred values for the K_2 and P_1 constituents (Godin, 1972). The tidal contribution to a given record could then be reconstructed, interpolated to 15 minute intervals and subtracted on a point-for-point basis from the original record. Finally, no corrections have been made for possible aliasing due to wave-induced rotor-pumping. Not only are summer wave heights relatively low, but the effect is typically confined to the high frequency end of the spectrum.

TABLE 1. Locations of current meters for two deployment periods in 1977. Nominal depths are determined from wire-lengths and calibrated pressure gauges (mean tidal range ≈ 3.5 m). V - velocity; T - temperature; C - conductivity; P - pressure; t - time-code generator. An 'x' means 100% data recovery; otherwise number gives percent data recovery.

A. FIRST DEPLOYMENT PERIOD (May-July)

STATION ID	LATITUDE deg.	LATITUDE min.	LONGITUDE deg.	LONGITUDE min.	DEPTH (m)	START DATE	DURATION (DAYS)	PARAMETERS MEASURED V	T	C	P	t
Q03	50	58.5	129	17.6	17	17 May	58	x	x	x	x	
	"		"		160	"	"	x	x	x	x	
Q04	51	19.3	129	01.6	24	17 May	58	x	70	70		x
	"		"		255	"	"	x	x	x	x	
Q05	51	22.0	130	01.0	7	18 May	63	x	x	x	x	
	"		"		275	"	"	x	x	x		x
Q07	52	20.5	130	17.5	10	22 May	59	x	x	x	x	
	"		"		330	"	"	x	x	x	x	
Q08	52	21.0	129	30.0	18	19 May	59	x	x	x	x	
	"		"		155	"	"	x	x	x	x	
CS01	52	52.7	129	53.8	16	20 May	57	x	x	x	x	
CS02	52	55.0	129	37.0	24	20 May	57	21	21	21	21	
	"		"		195	"	"	x	x		x	
CS03	52	54.0	129	19.0	20	20 May	57	x	x	x	x	
H01	53	28.9	130	46.2	16	21 May	58	x	x	x		
	"		"		155	"	"	x	x	x		x
H02	53	41.3	130	31.5	20	21 May	58	x	x		x	

TABLE 1. (Continued)

B. SECOND DEPLOYMENT PERIOD (July-September)

STATION ID	LATITUDE deg.	LATITUDE min.	LONGITUDE deg.	LONGITUDE min.	DEPTH (m)	START DATE	DURATION (DAYS)	PARAMETERS MEASURED V	T	C	P	t
Q03	50	58.9	129	16.9	10	15 July	67	x	x	x	x	
	"		"		160	"	"	x	x	x	x	
Q04	51	18.9	129	02.0	15	14 July	67	x	x	x		x
	"		"		250	"	"	x	x	x	x	
Q07	52	20.2	130	19.5	10	17 July	66	x	x	x	x	
	"		"		325	"	"	15	15		15	
Q08	52	20.9	129	29.6	16	17 July	68	31	31	31	31	
	"		"		155	"	"	x	x	x	x	
CS01	52	52.9	129	54.3	18	16 July	70	x	x	x	x	
CS02	52	55.0	129	37.0	13	16 July	68	x	x	x	x	
	"		"		190	"	68	x	x	x	x	
CS03	52	54.0	129	19.0	24	16 July	67	36	36	36	36	
H01	53	28.8	130	45.7	15	18 July	68	x	x	x		
	"		"		155	"	68	x	x	60	x	
H02	53	41.2	129	31.5	20	18 July	68	43	43	43	43	

Oceanic wind measurements were obtained every 30 min from a moored anemometer at the entrance to Queen Charlotte Sound. Use has also been made of six-hourly weather maps and hourly wind records routinely collected at manned lighthouse stations around the perimeter of the region (Fig. 1).

Water property data were collected within the region in May, July and September. Observations consisted mainly of CTD profiles digitally sampled every 0.1 s and taken to within a few metres of the bottom. Niskin bottle observations were used to calibrate the CTD data (Thomson et al, 1981).

Bandpass filtered data

To effectively isolate the near-inertial currents, we first subtracted the calculated tidal current constituents from the edited records. The modified records were then processed forwards and backwards with a high order bandpass Butterworth filter (Thomson and Chow, 1980). Although the squared filter response (Fig. 2) has relatively high magnitude ($\sim$0.25) at the major tidal frequencies, removal of the harmonic constituents ensures minimal tidal contamination of energy variance in the inertial band. This is demonstrated in Table 2 where rotary spectra are compared at selected frequency bands for the above stages of processing. The filter amplitude exceeds 80% in the 0.049 - 0.068 cph range and 90% in the 0.052 - 0.064 cph range. Where the absolute values are required we have compensated for filter attenuation.

The "ringing" effect due to application of the filter to a finite length record is illustrated in Fig. 3. Here, the bandpass filter spreads the original inertial signal over two additional cycles (roughly 31 h) and results in an underestimation of the actual amplitude at the beginning and end of the input wave form: however, the phases of the input and output are identical. In reality, the wind-induced currents probably began less abruptly than in Fig. 3 so that amplitudes of actual and filtered records would be in closer agreement. Moreover, the long duration of the inertial signals during the major events is conducive to a good overall fit by the filtered amplitude.

To analyze the current data, we have applied a series of spectral and cross-spectral rotary-component analysis programs written by S. Yuen (personal communication) based on the work of Gonella (1972) and Mooers (1973).

3. WIND AND CURRENT COMPONENTS

The east-west (u) and north-south (v) velocity components of edited current records, the corresponding tide-removed bandpass filtered records, and the oceanic wind are plotted in Figs. 4a-d. As these plots illustrate, currents within the coastal sea consisted of intermittent bursts of inertial current activity superimposed upon predominant, semidiurnal tidal currents and a weaker, slowly varying mean flow. The inertial currents at exposed locations were relatively strong (> 5 cm s^{-1}) at near-surface depths but consistently weak at near-bottom depths (Figs. 4b, d); moderate amplitude near-surface oscillations were recorded within adjoining passages. A typical wave group in the surface layer persisted about three to four inertial periods before undergoing marked attenuation.

Figure 2. Zero-phase shift, band-pass filter formed using seventh order low-pass and eighth order high-pass Butterworth filters. Arrows indicate frequencies of major tidal constituents.

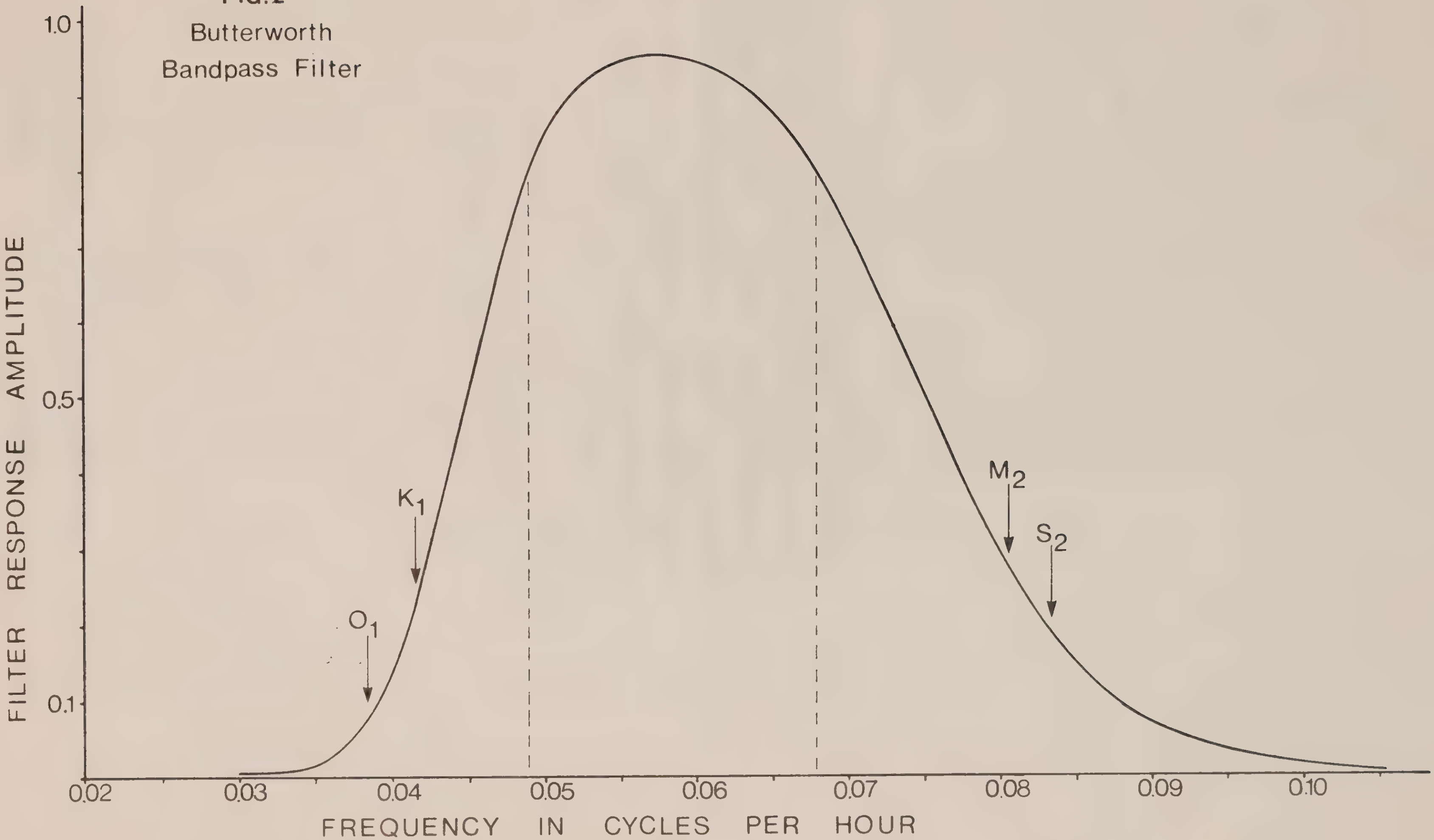


FIG. 2
Butterworth
Bandpass Filter

Figure 3. Response of band-pass filter (solid line) to truncated current record (dashed line). Inputs consist of 15-min sampled current components from which tidal constituents have been subtracted and for which amplitudes are set to zero after 4 and 2 inertial periods (cycles).

FIG. 3

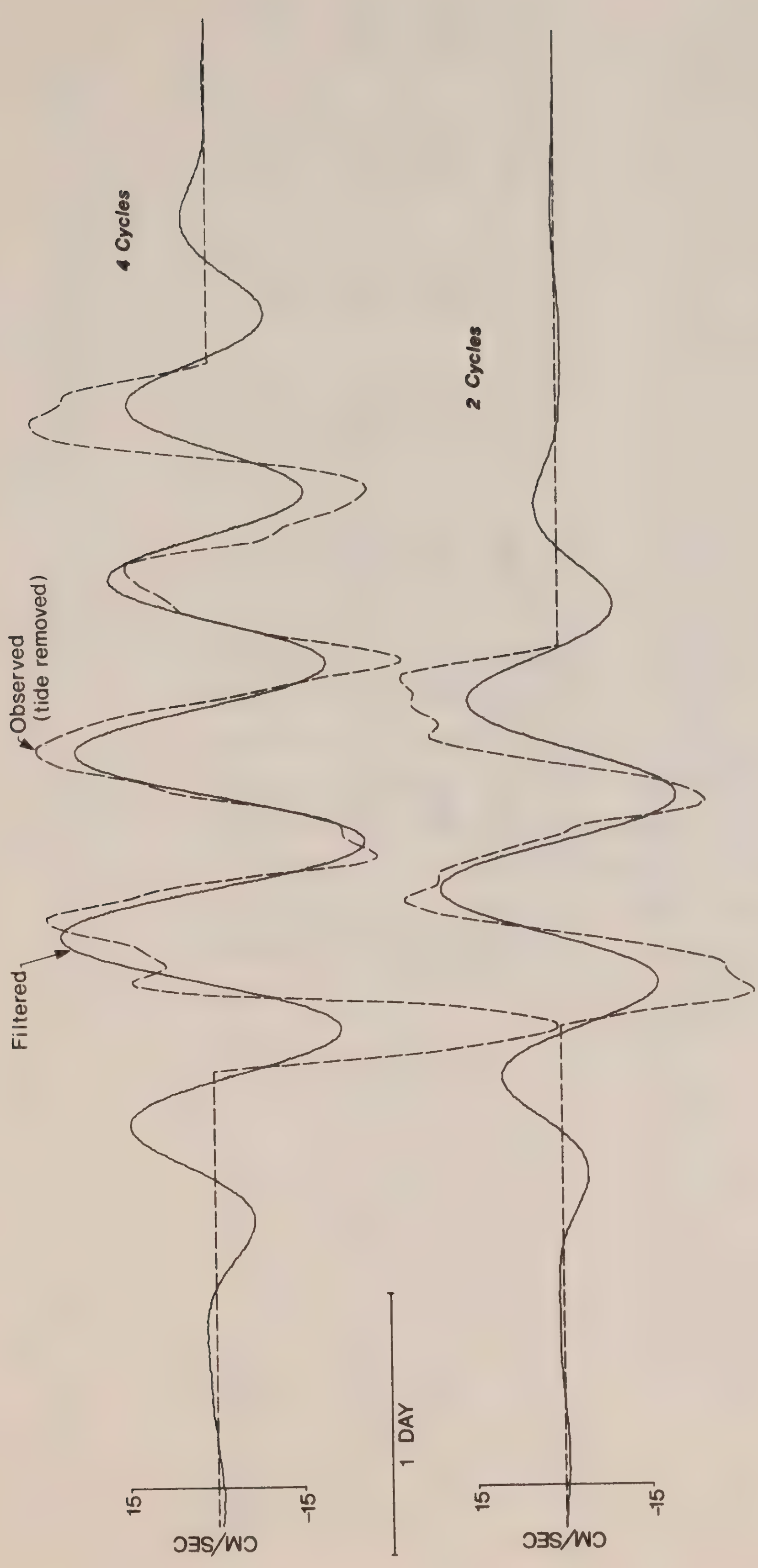

Filtered
Observed
(tide removed)
4 Cycles
2 Cycles
1 DAY
CM/SEC
15
-15
CM/SEC
15
-15

TABLE 2. Comparison of spectra ($cm^2 s^{-2}$ cph^{-1}) for Station Q03 (17 m) for three stages of data processing. Data cover a period of 42.7 days beginning 18 May 1977. Bandwidth is 0.005 cph and there are 10 degrees of freedom. First line in each row is clockwise spectrum, second line counterclockwise spectrum. First row: spectra for edited-only data. Second row: for data record in which tidal constituents have been removed based on harmonic analysis of entire record. Third row: for data record in which tidal constituents were removed and resultant record bandpass filtered using a combined 7th order low-pass Butterworth filter (-3db at 0.075 cph) and 8th order high-pass Butterworth filter (-3db at 0.045 cph).

	FREQUENCY (CPH)									
	0.035	0.040	0.045	0.050	0.055	0.060	0.065	0.070	0.075	0.080
EDITED ONLY	696 230	539 444	844 238	2089 105	1961 115	3667 82	16105 103	9873 183	1178 411	96989 5852
TIDES-REMOVED	744 223	204 63	577 205	2091 101	1959 116	3678 81	16107 104	9909 201	1209 349	3579 304
TIDES-REMOVED AND FILTERED	0 0	8 1	180 64	1504 72	1698 100	3171 71	12075 80	5246 95	337 78	294 23

Figure 4. The next four figures present comparisons of oceanic winds and currents at Stations Q03 and Q05 for the first deployment period (May-July 1977). A/C: north-south and east-west components of observed near-surface and near-bottom currents. B/D: components of band-pass filtered currents, corresponding to A/C, with tidal constituents subtracted (no filter compensation). Arrows in A mark times of major June fronts. Oceanic convention is used for winds, so that winds are toward the directions shown.

FIG. 4A

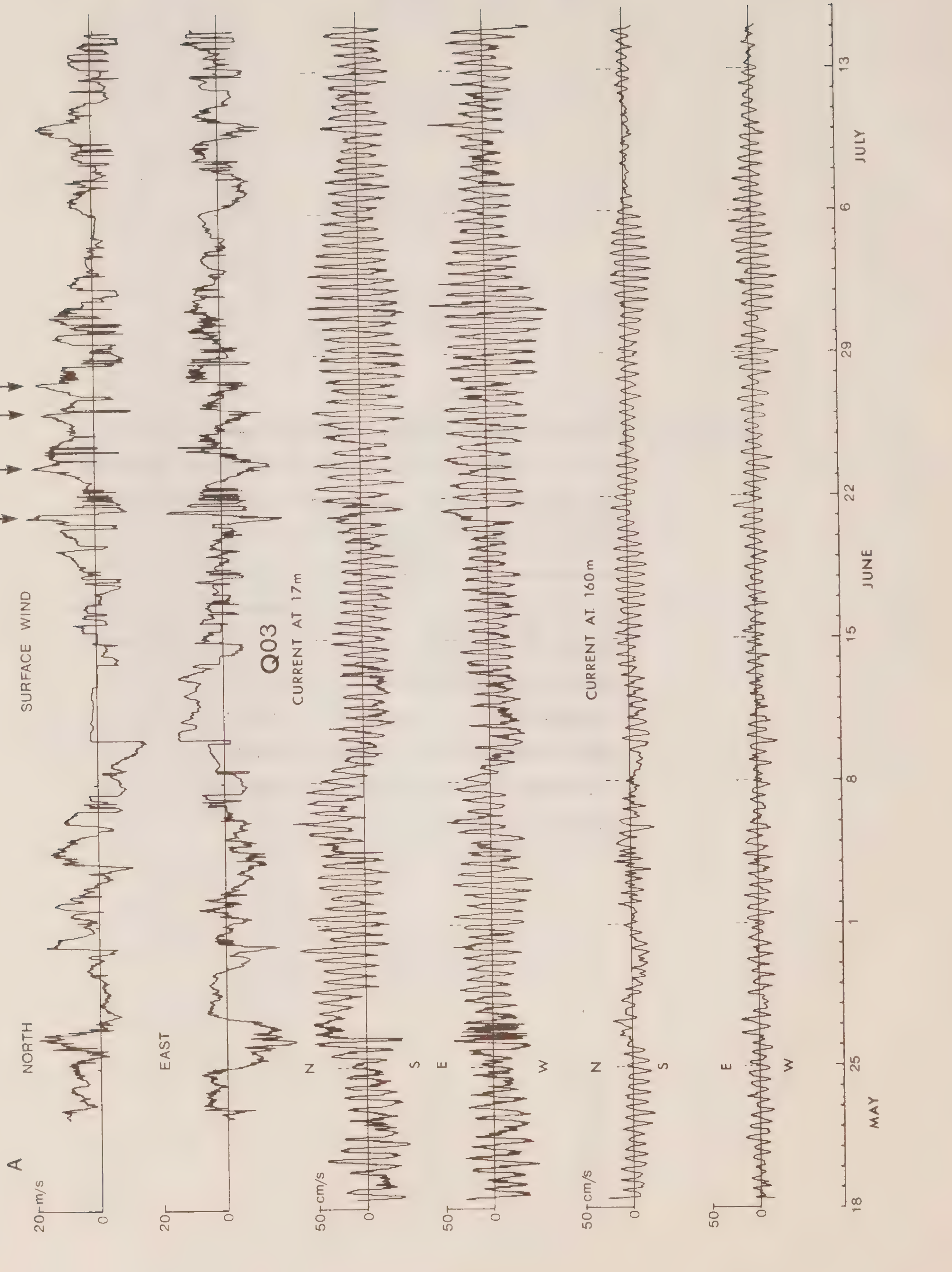

A
SURFACE WIND
NORTH
EAST
20 m/s
0
20
0
Q03
CURRENT AT 17m
50 cm/s
0
N
S
50
0
E
W
CURRENT AT 160m
50 cm/s
0
N
S
50
0
E
W
18
25
1
8
15
22
29
6
13
MAY
JUNE
JULY

FIG.4B

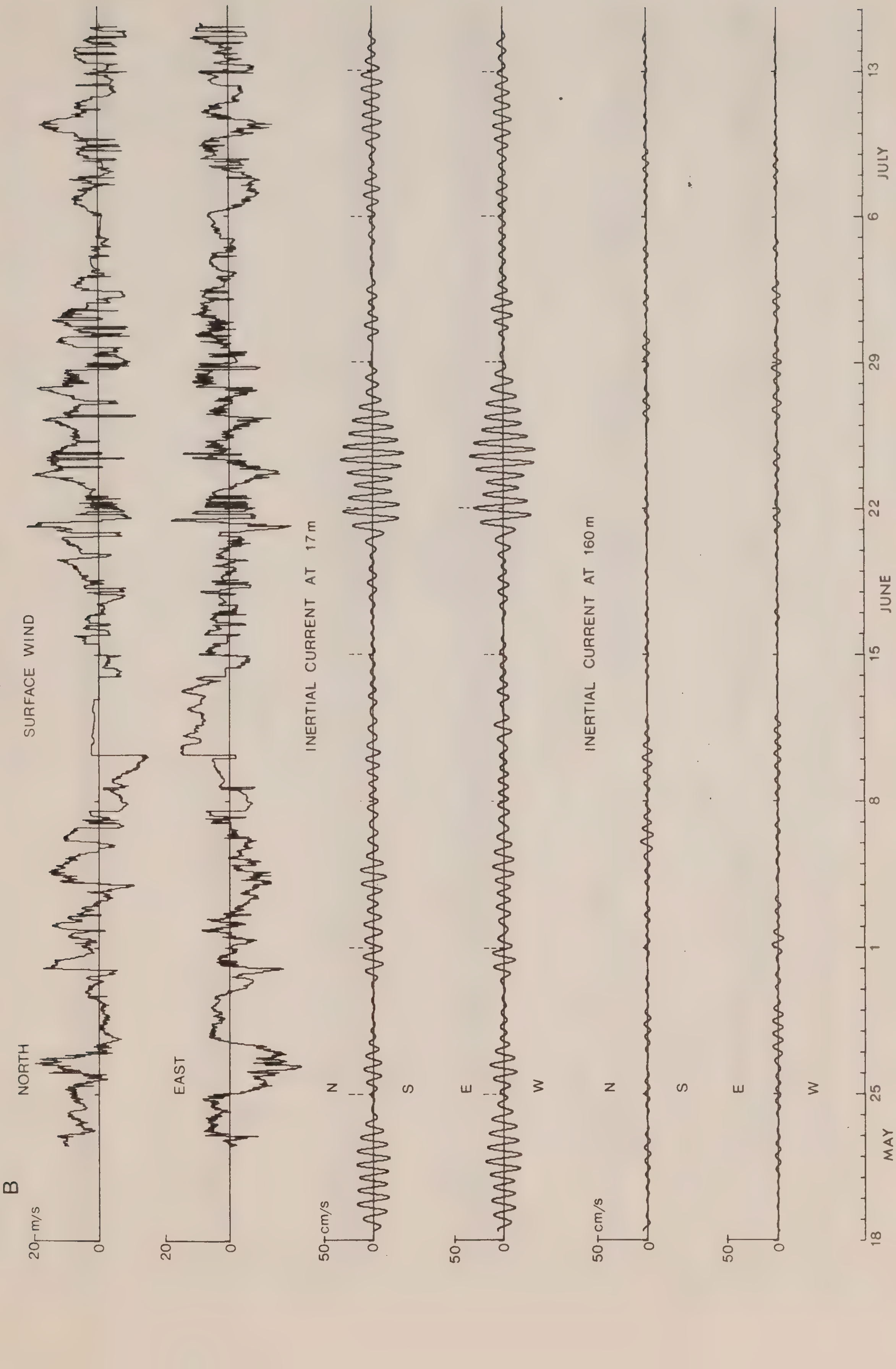
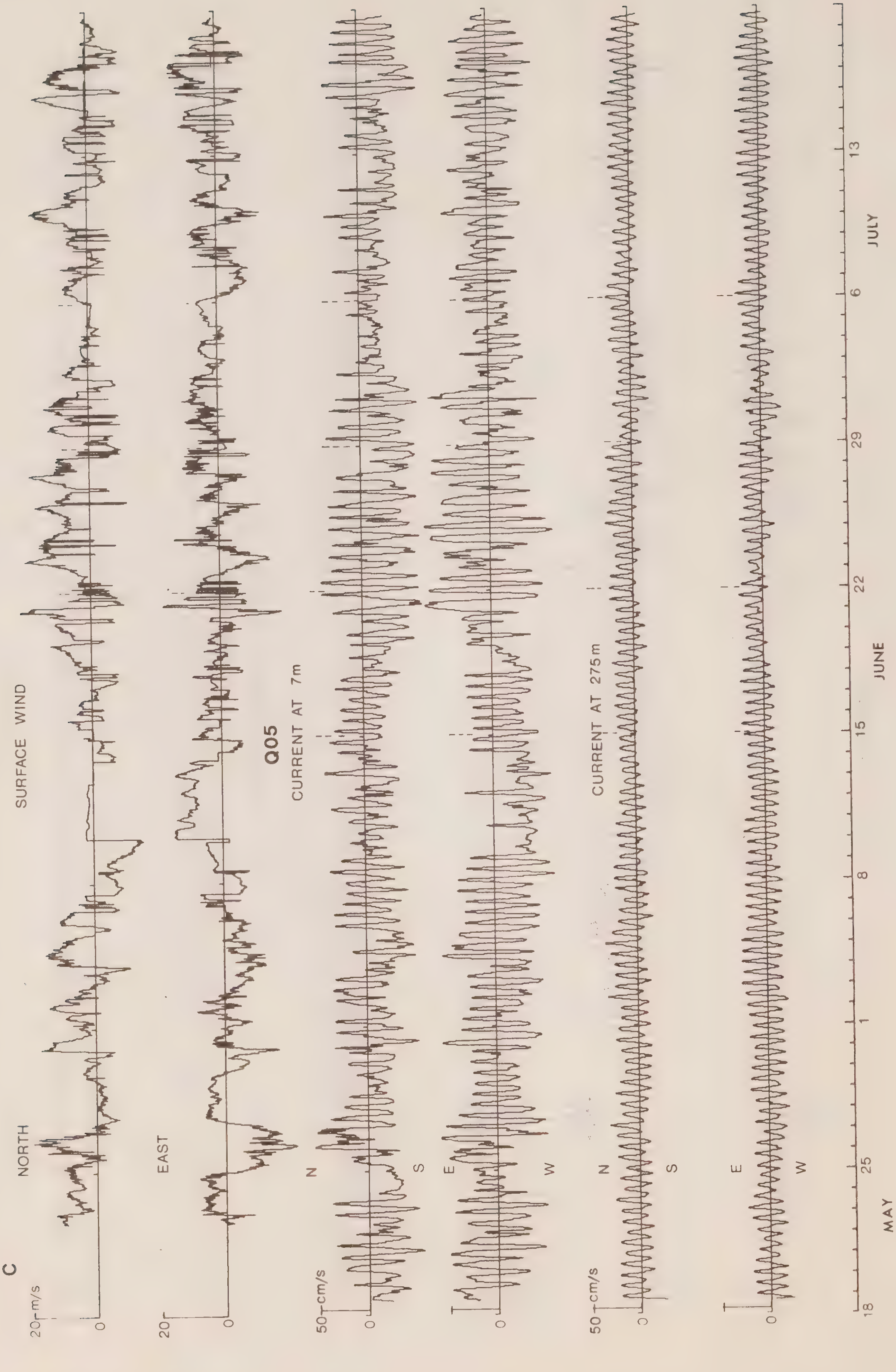

B
SURFACE WIND
NORTH
20 m/s
0
EAST
20
0
INERTIAL CURRENT AT 17 m
50 cm/s
0
N
S
50
0
E
W
INERTIAL CURRENT AT 160 m
50 cm/s
0
N
S
50
0
E
W
18
25
1
8
15
22
29
6
13
MAY
JUNE
JULY

FIG. 4C


C
SURFACE WIND
NORTH
EAST
20 m/s
0
20
0
Q05
CURRENT AT 7m
N
S
E
W
50 cm/s
0
0
CURRENT AT 275m
N
S
E
W
50 cm/s
0
0
18
25
1
8
15
22
29
6
13
MAY
JUNE
JULY

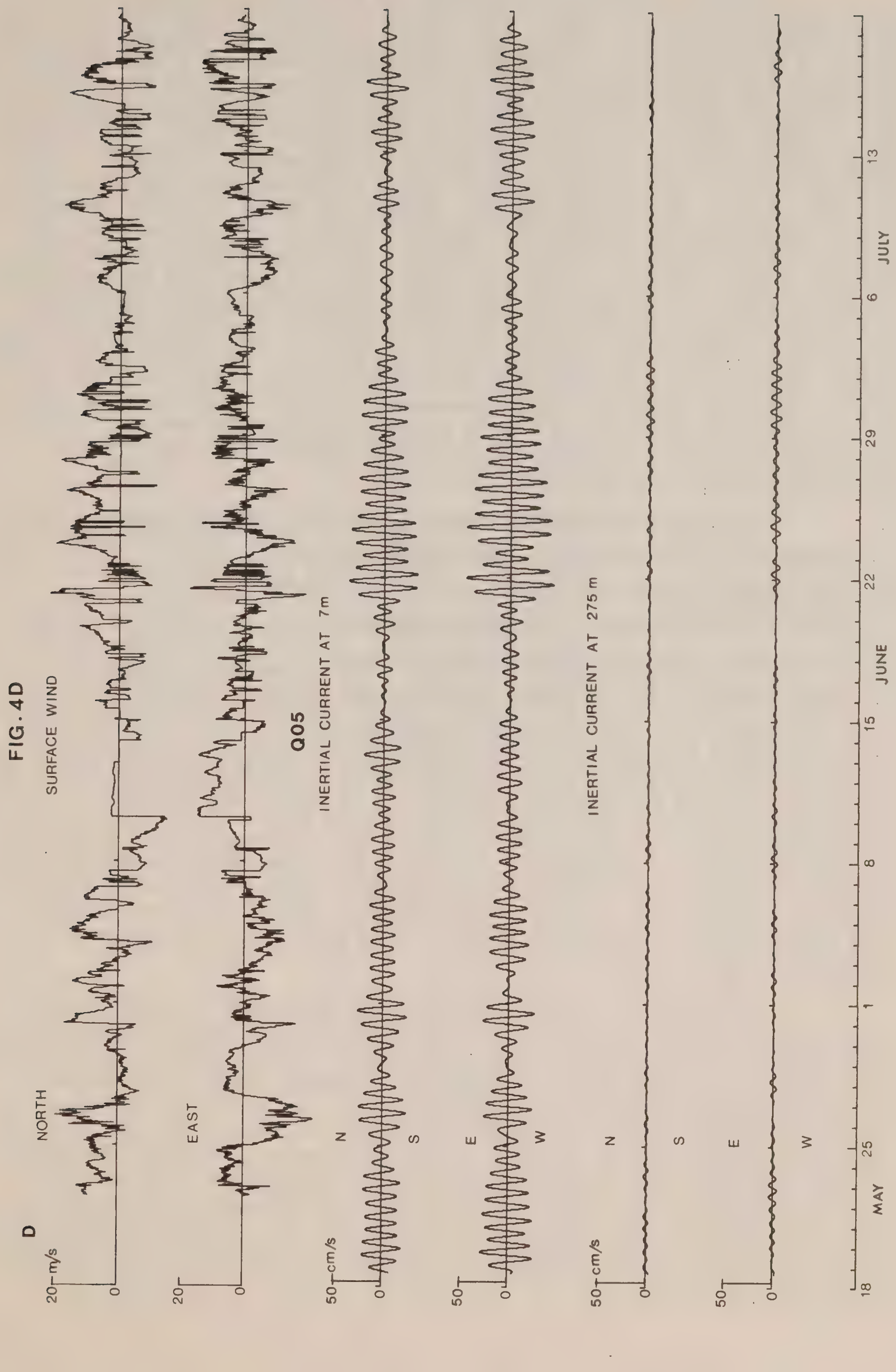

D
SURFACE WIND
NORTH
EAST
Q05
INERTIAL CURRENT AT 7m
N
S
E
W
INERTIAL CURRENT AT 275 m
N
S
E
W
20 m/s
0
20
0
50 cm/s
0
50
0
50 cm/s
0
50
0
18
25
1
8
15
22
29
6
13
MAY
JUNE
JULY

FIG. 4D

Visual comparison of the wind and near-surface currents in Figs. 4b,d indicates that major inertial fluctuations with speeds in excess of approximately 10 cm s^{-1} were associated with times of moderate-to-strong (10 to 20 m s^{-1}) southeast winds that accompanied eastward moving extratropical cyclones. For single inertial events, or for the first event of a sequence, the southeast winds usually veered to south or southwest winds after reaching peak speeds; observed clockwise rotation rates of 20 to 30° h^{-1} in certain cases were especially favorable to the local generation of inertial currents (period 15.4 h). The series of four "storms" that produced the persistent inertial signals of mid-June had peak winds about 60-64 h apart. Because the latter corresponds to roughly four inertial periods, it appears that near-resonant wind forcing had occurred in which the decelerating current vector associated with one wind system was given a boost by the wind stress of the following system. The winds of successive storms also veered and reached peak speeds lasting several hours during which time they were aligned in the general direction of the existing inertial current. The second major event period (mid-August) coincided with successive storms roughly 32 h and 92 h apart. Although the latter time corresponded to nearly six inertial periods, the currents generated by the second storm appear to have been sufficiently attenuated upon the arrival of the third wind system that they did not appreciably affect the resultant oscillation.

At times of significant inertial events, the near-surface velocity components (Figs. 4b,d) were of nearly equal magnitude with u lagging v by approximately 90° (c.f. Section 7). All filtered near-surface records from exposed regions showed similar circularly polarized, clockwise rotary behaviour. Consequently, only the u-component has been displayed in the aggregate plots for the region (Figs. 5a,b); records from the near-bottom meters possessed weak, highly elliptical oscillations in the inertial frequency band and are excluded. The inertial oscillations were clearly less energetic and of shorter duration during the second deployment period compared to the first while in both cases maximum current amplitudes tended to occur in the more exposed southwestern region and minimum amplitudes in the more protected northeastern region. In mid-June, near-surface inertial oscillations persisted more than a week at most stations and attained maximum filter-compensated speeds of ∿50 cm s^{-1} at Q05 and 30-40 cm s^{-1} at other exposed locations. Depending upon the response time to the wind, the actual speeds of the inertial oscillations at Station Q05 could, according to Fig. 3, have exceeded the compensated filtered value. More specifically, the tide-removed record at the onset of this event (Fig. 6) suggests a maximum current amplitude of 75 cm s^{-1}.

The clockwise-rotary nature of the inertial oscillations is consistent with a downward component of group velocity (Leaman and Sanford, 1975) and, therefore, surface wind-generation. Evidence for wind-generation also follows from the close correspondence between onset of the inertial oscillations and passage of eastward traveling extratropical cyclones. However, attempts to more precisely determine the onset times of inertial oscillations relative to the arrival of the generating wind at the single moored anemometer station were unsuccessful. Regardless of which set of current components were used (edited-only, tide-removed, or bandpass-filtered) it proved impossible to establish, on the basis of expanded plots of the currents, the beginning of an inertial oscillation to better than a few hours. Moreover, the wind current lags were more determinate at some

Figure 5. The next two figures present aggregate plots of east-west components of near-surface inertial currents for all moorings. Records are band-pass filtered (tidal constituents subtracted) with no filter compensation. Number following mooring name gives nominal depth in meters. Oceanic wind vectors are plotted every 3 hours. A. First deployment period. B. Second deployment period.

FIG. 5A.

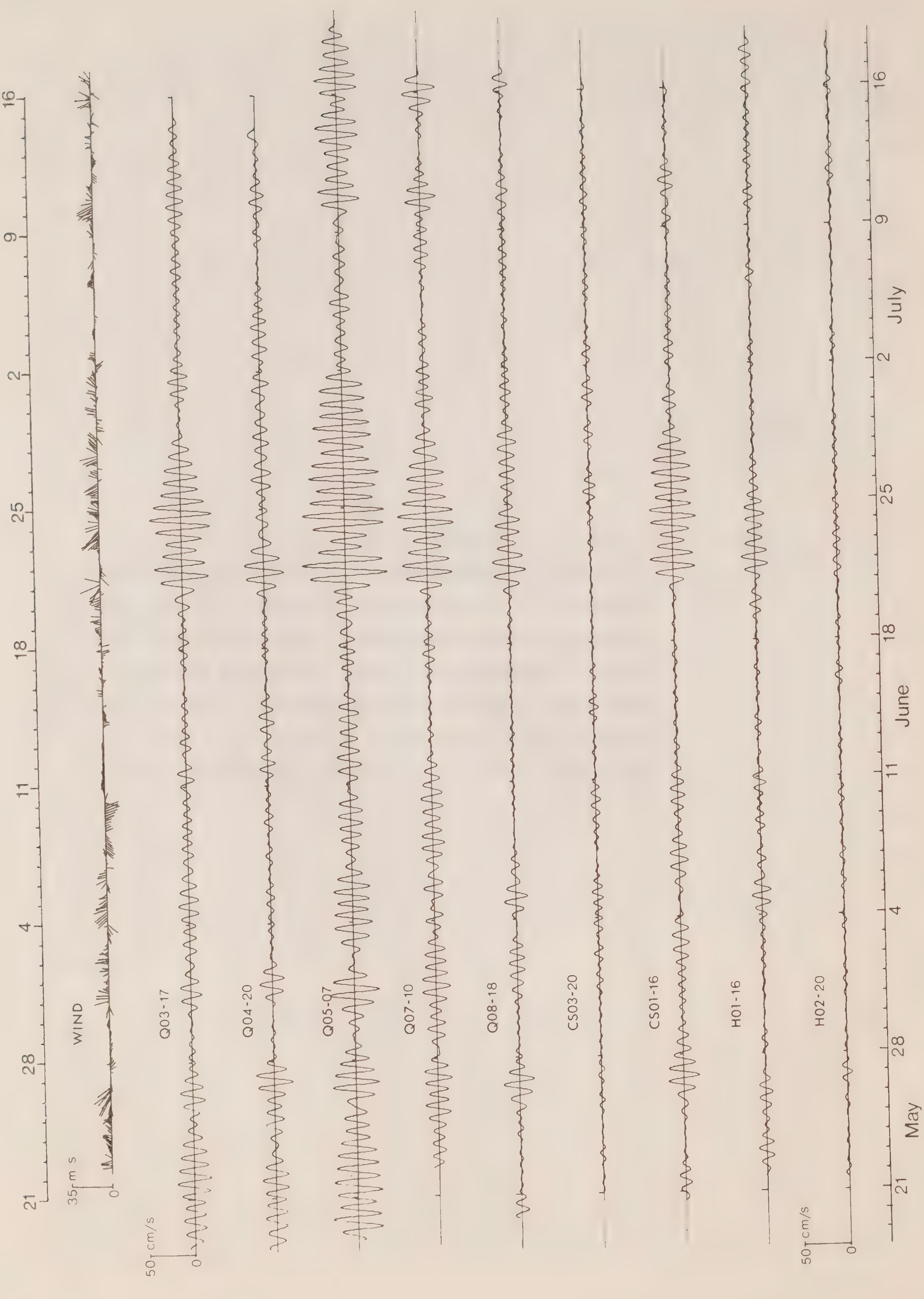
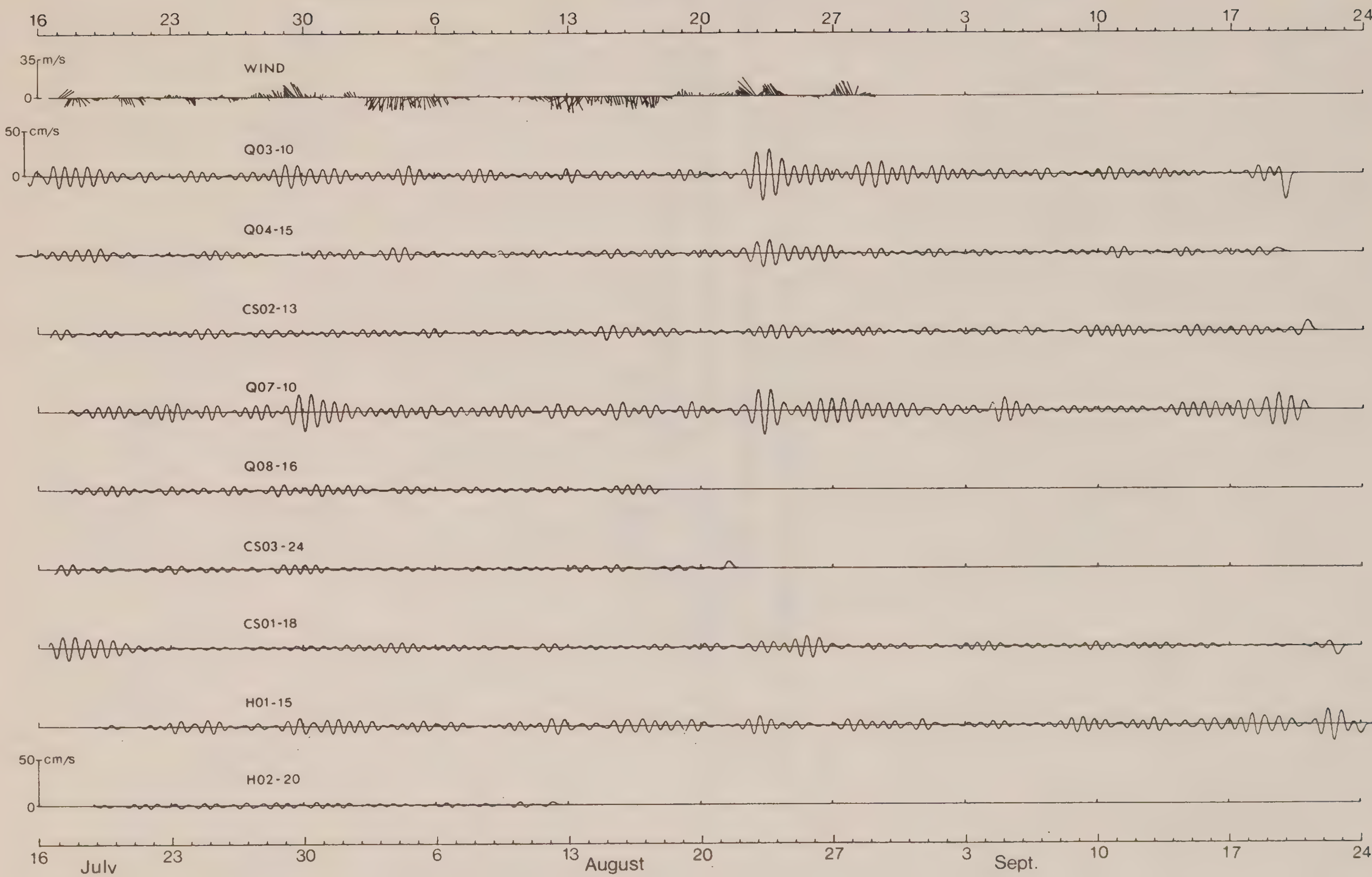

21
28
4
11
18
25
2
9
16
35 m s
0
WIND
50 cm/s
0
Q03-17
Q04-20
Q05-07
Q07-10
Q08-18
CS03-20
CS01-16
H01-16
H02-20
50 cm/s
0
21
28
4
11
18
25
2
9
16
May
June
July

FIG. 5B.



16
23
30
6
13
20
27
3
10
17
24
35 m/s
0
WIND
50 cm/s
0
Q03-10
Q04-15
CS02-13
Q07-10
Q08-16
CS03-24
CS01-18
H01-15
50 cm/s
0
H02-20
July
August
Sept.

Figure 6. Hourly non-tidal currents at Station Q05 beginning 20:00 June 20, 1977. The tidal current constituents, based on the full 63-day record length, have been extracted from the two components.

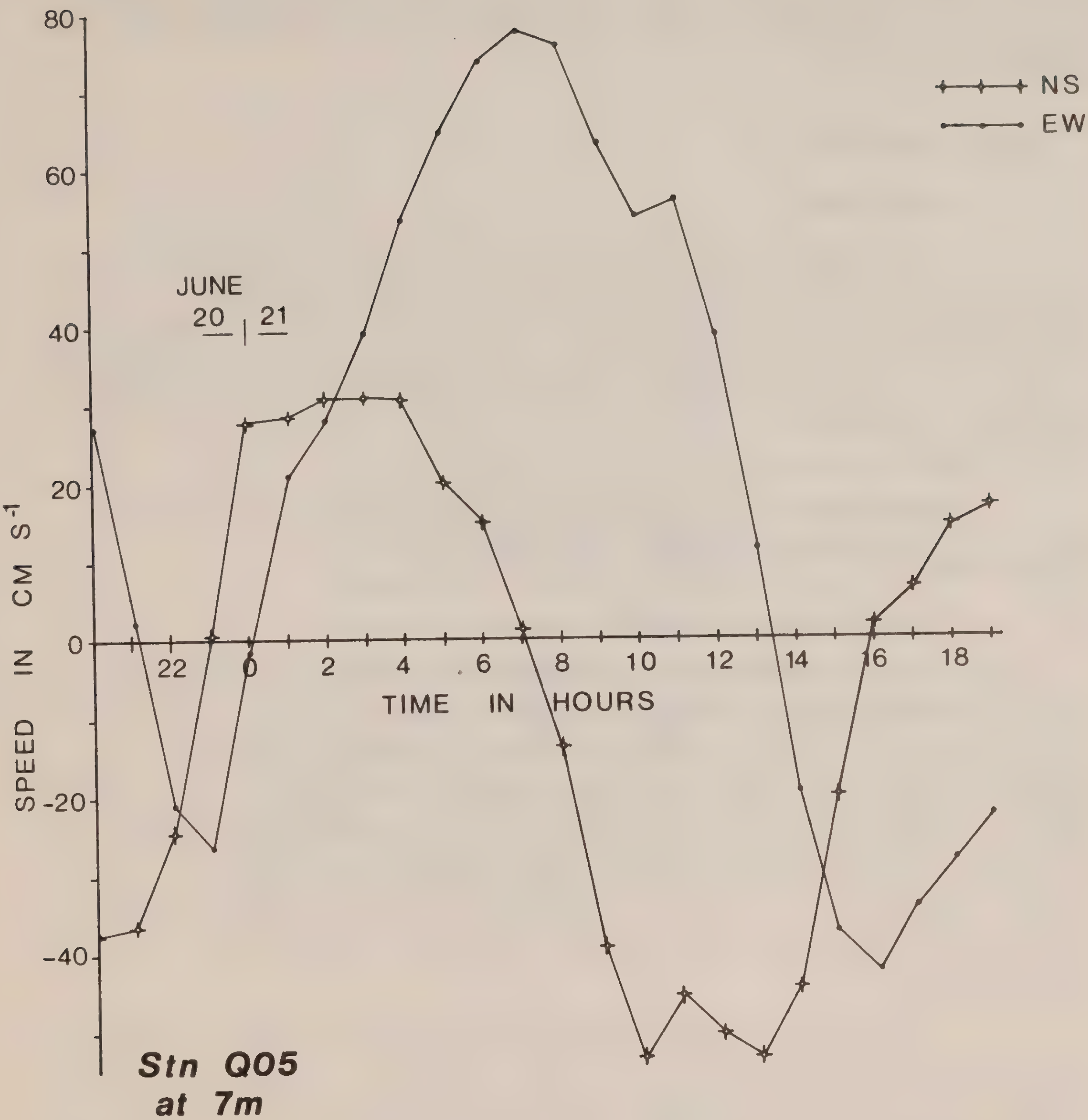

80
60
40
20
0
-20
-40
SPEED IN CM S-1
JUNE
20 | 21
NS
EW
22
0
2
4
6
8
10
12
14
16
18
TIME IN HOURS
Stn Q05
at 7m

FIG. 6

locations than others so that even accurate intercomparisons among mooring locations were not possible. Lastly, the large spatial separations of the moorings together with the modification of winds by the land and the strong dependence of inertial currents on the local wind field indicates that an accurate comparison of winds and currents would only have been possible with detailed oceanic wind measurements. (In Section 6, relative current phases derived from an admittance analysis are compared with the estimated phase of the generating wind.)

4. SPECTRAL AMPLITUDES

Major peaks

Representative spectra for the coastal sea are presented in Figs. 7a-g. The major contribution to the kinetic energy variance was from the M_2 semidiurnal tidal current followed, in the upper zone, by a contribution from inertial oscillations; comparatively little energy existed at the S_2, K_1 and O_1 tidal frequencies. Low frequency energy was generally comparable in magnitude to that at diurnal frequencies but varied considerably with depth and location. There was little inertial energy at near-bottom current meters.

Significant inertial energy was prevalent in all spectra from near-surface moorings in the exposed portion of the region and was almost entirely associated with clockwise rotary currents.

Peak inertial frequencies

Previous investigations indicate that the peak spectral frequency ($\omega = \omega_p$) of inertial oscillations typically exceeds the local inertial frequency, f, by 3-20% (e.g. Kundu, 1976). In the absence of a mean flow or horizontal density gradient, the group velocity becomes increasingly horizontal as $\omega \to f$, so that the above observation presumably results because inertial motions measured at subsurface depths in a stratified fluid must be those for which there has been a downward flux of wind-generated energy. An alternate explanation proposed by Anderson and Gill (1979) links the higher frequencies to southward wave propagation in the presence of a meridionally variable f. In either explanation, oscillations of subinertial frequency are discounted since the wave frequencies theoretically lie in the usual pass $f \leqslant \omega \leqslant N$.

To accurately determine the peak frequencies, we have computed the high resolution rotary spectra using a bandwidth of 0.002 cph (Fig. 8a-c). Based on the local inertial period and the spectra for locations that had significant near-surface inertial activity, three separate regions are distinguishable: the outer shelf region represented by Stations Q03 and Q05, characterized by large amplitude clockwise-rotary oscillations with sharply defined peak frequencies ∿3.5% above f; the inner shelf represented by Q07, Q08, H01 and CS01, characterized by moderate amplitude clockwise oscillations with broad spectral maxima centered at f; and the southeastern shelf region near Q04 with moderate amplitudes and sharply defined peak frequencies ∿6.5% below f. With the exception of Station Q04, typical peak frequencies were at 0.066 cph; at Q04 the largest peak was at 0.062 cph and

Figure 7. The next seven diagrams present representative rotary spectra for the first 1024 h of given record. Solid line - clockwise component; dashed line - counterclockwise component. Nyquist frequency = 2 cph; bandwidth = 0.005 cph; degrees of freedom = 10. Only the first 100 bands have been plotted. Letters refer to the main diurnal (K_1) and main semi-diurnal (M_2) tidal current constituents and to the local Coriolis frequency (f). Vertical bar gives approximate 95% confidence interval.

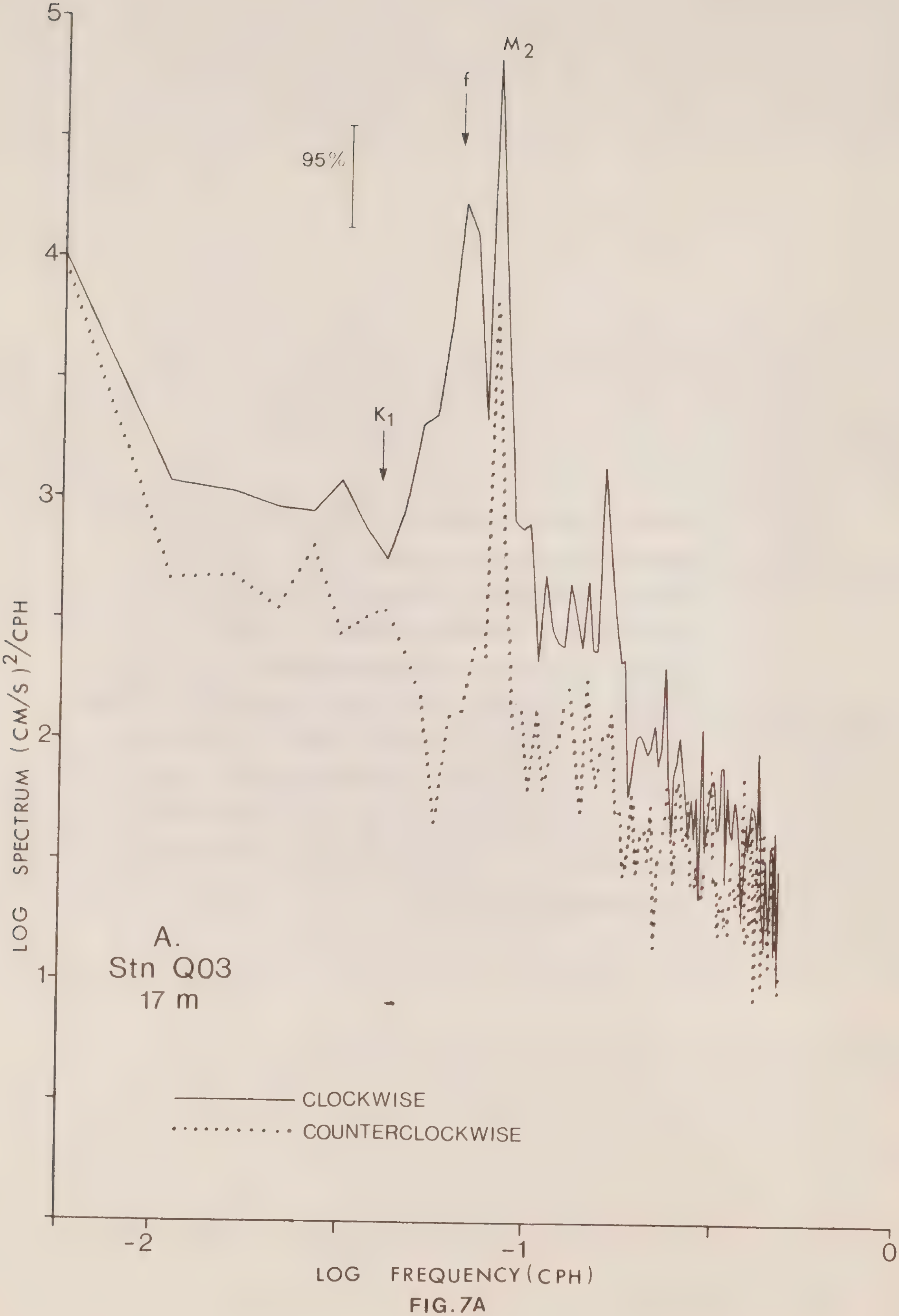

5
4
3
2
1
M2
f
95%
K1
A.
Stn Q03
17 m
CLOCKWISE
COUNTERCLOCKWISE
-2
-1
0
LOG SPECTRUM (CM/S)²/CPH
LOG FREQUENCY (CPH)

FIG. 7A

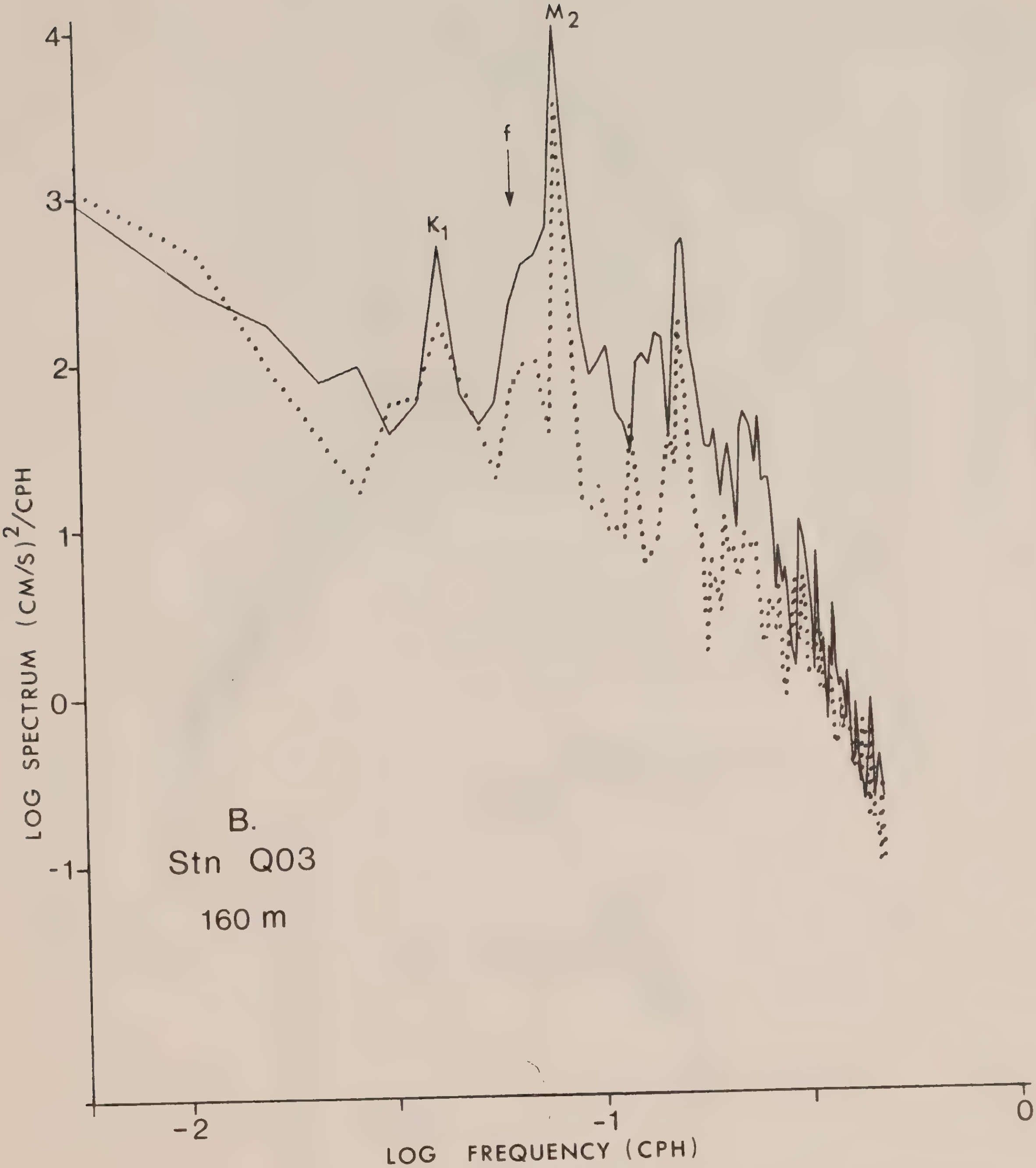
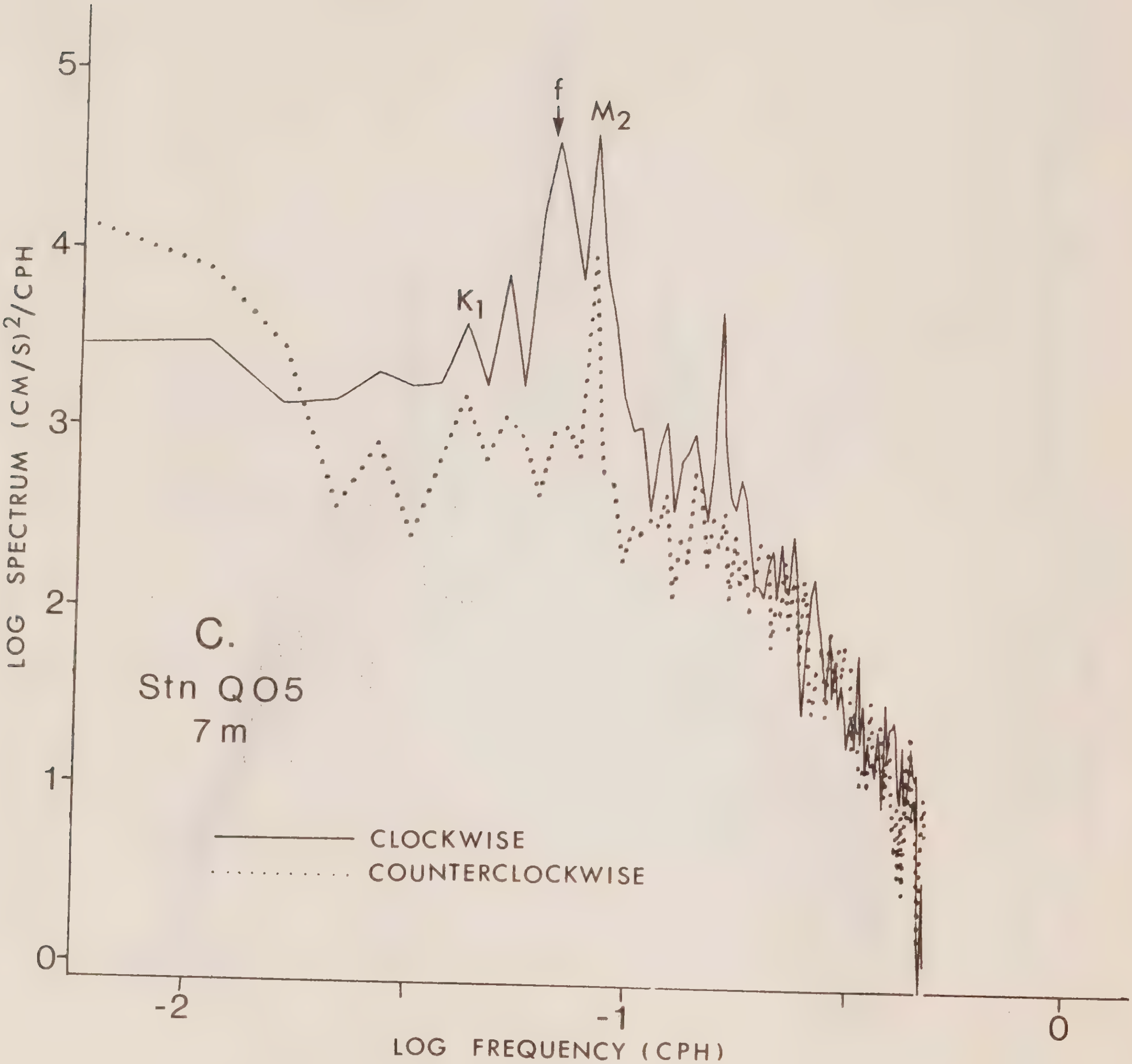

M2
f
K1
4
3
2
1
0
-1
LOG SPECTRUM (CM/S)2/CPH
B.
Stn Q03
160 m
-2
-1
0
LOG FREQUENCY (CPH)

FIG.7B



5
4
3
2
1
0
LOG SPECTRUM (CM/S)^2/CPH
f
M_2
K_1
C.
Stn QO5
7 m
CLOCKWISE
COUNTERCLOCKWISE
-2
-1
0
LOG FREQUENCY (CPH)

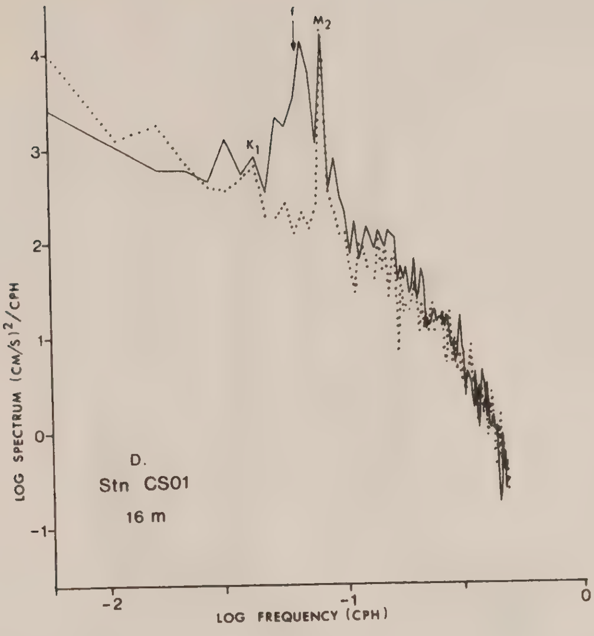

f
M_2
K_1
4
3
2
1
0
-1
LOG SPECTRUM $(CM/S)^2/CPH$
D.
Stn CS01
16 m
-2
-1
0
LOG FREQUENCY (CPH)

FIG. 7D

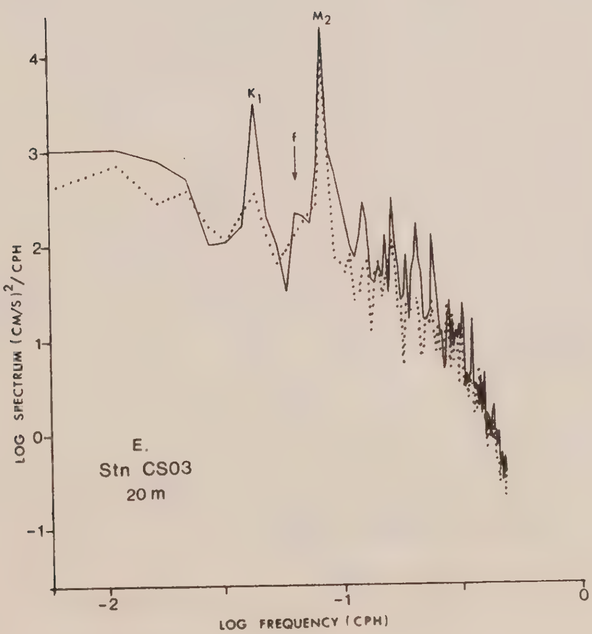

M_2
K_1
f
4
3
2
1
0
-1
LOG SPECTRUM $(CM/S)^2/CPH$
E.
Stn CS03
20 m
-2
-1
0
LOG FREQUENCY (CPH)

FIG. 7E

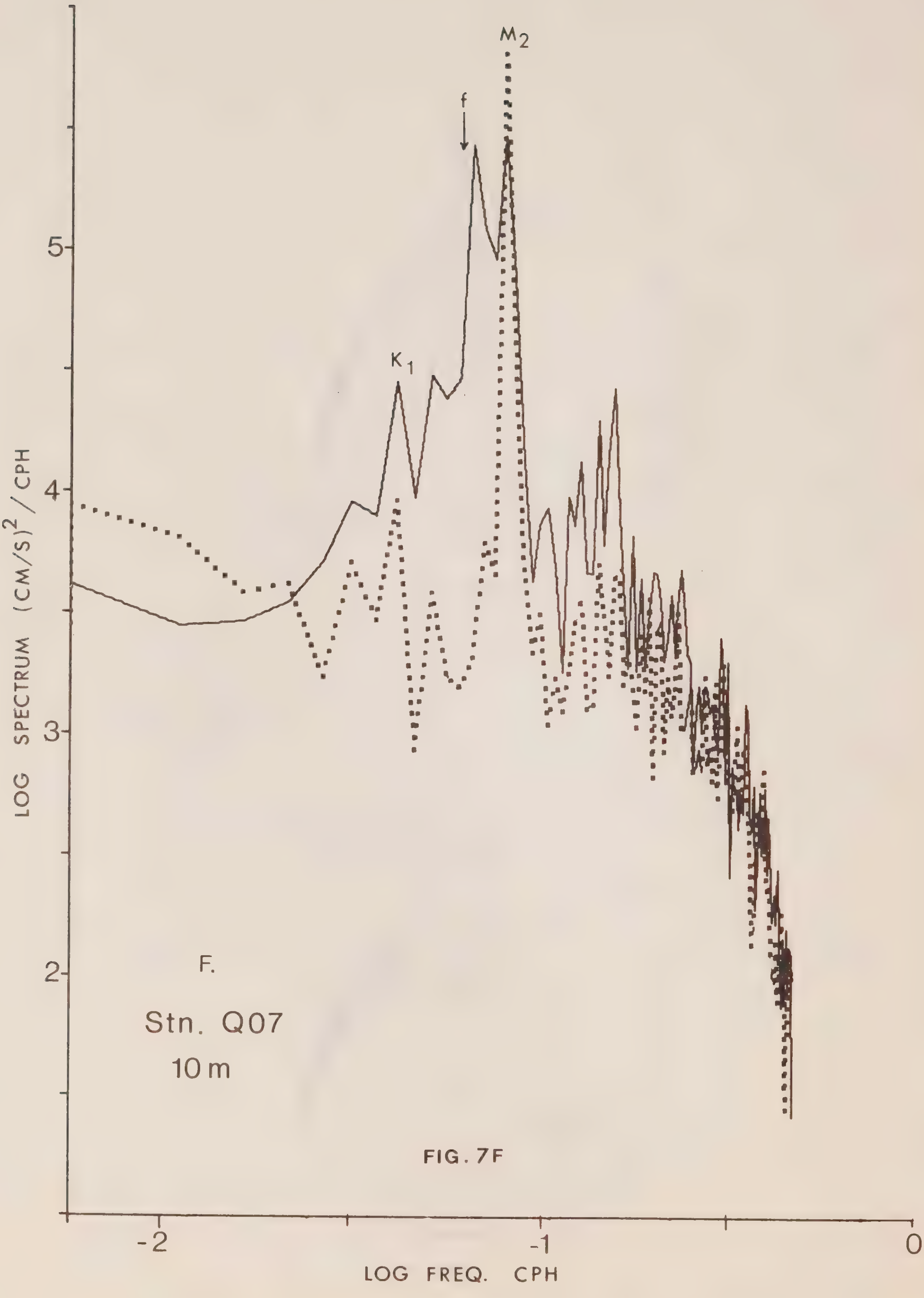

M2
f
K1
5
4
3
2
LOG SPECTRUM (CM/S)^2 / CPH
F.
Stn. Q07
10 m
-2
-1
0
LOG FREQ. CPH

FIG. 7F

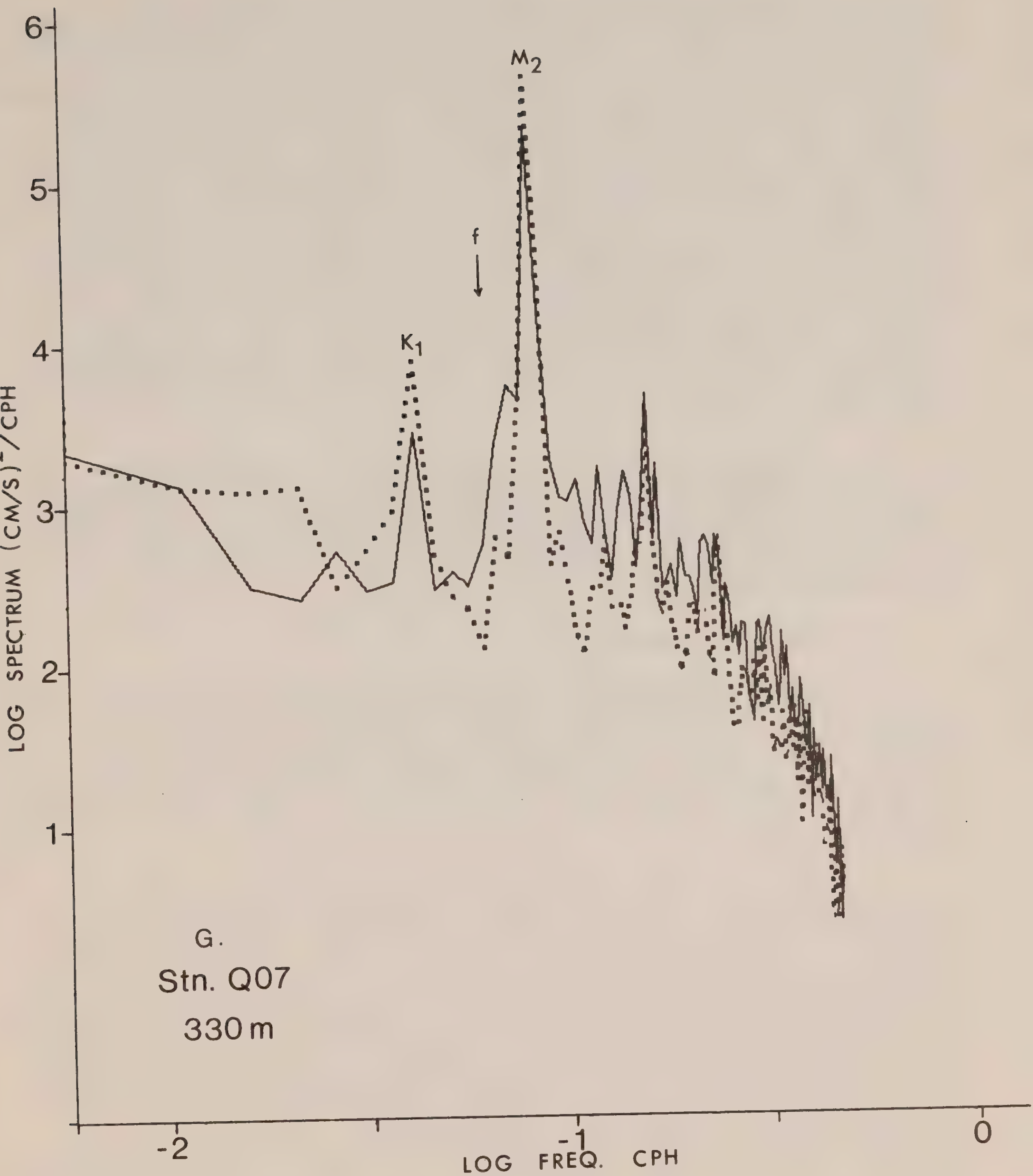

M2
K1
f
6
5
4
3
2
1
LOG SPECTRUM (CM/S)2/CPH
G.
Stn. Q07
330 m
-2
-1
0
LOG FREQ. CPH

FIG. 7G

coincided with secondary maxima in the spectra for Stations Q03 (second deployment) and Q05 (first deployment).

Based on the limited spectral resolution of these results, the frequencies of large amplitude inertial waves were at most a few percentage above the local inertial frequency. The broad spectral peaks from surface moorings north of Cape St. James and the secondary peaks at Q03 and Q05 further suggest that motions of subinertial frequency were common throughout exposed regions of the sea. (Alternatively, the broad peaks could have resulted from shorter durations of inertial events.) At location Q04, the peak frequency was decidely subinertial. We discount the possibility that the latter oscillations were due to timing errors during the observational stage since the current meter generated a corroborative time-word by an independent clock. The bandwidths of the major peaks in Fig. 8 are about 0.008-0.010 cph. Because signal persistence equals the reciprocal of the bandwidth (Munk and Phillips, 1968), the characteristic duration of the inertial oscillations were approximately 4-5 days or about eight inertial periods. But these estimates are heavily weighted by the major events associated with successions of storms. For a given storm, the individual wave groups of Figs. 4 and 5 had durations closer to 2½ days, more in line with previous findings.

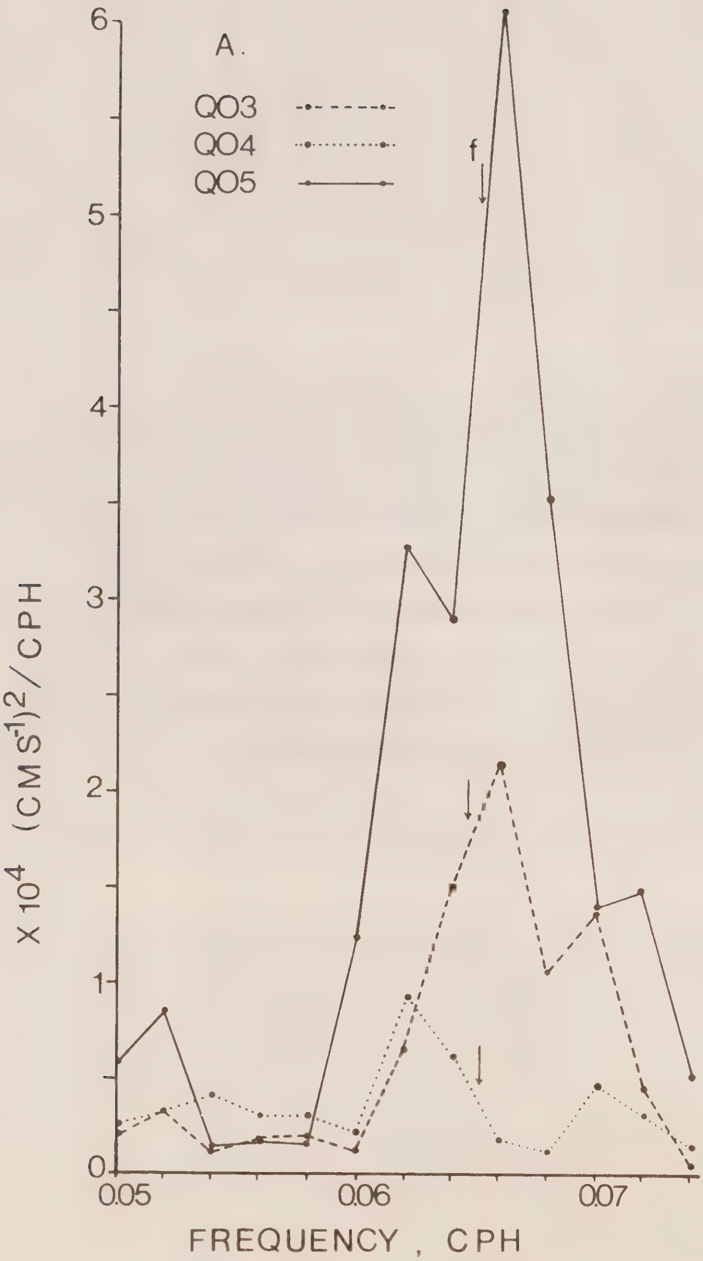
Maxima in the high resolution spectra of the anticlockwise rotating components were an order of magnitude less than for the clockwise component. Values were greatest at outermost moorings Q03, Q05 and Q07 and decreased toward the mainland coast: at none of the stations, however, are spectral peaks of the counterclockwise components significant to the 90% confidence level.

Temporal variability

Figures 9a,b present the temporal variability of clockwise rotary spectra within the inertial band based on 64-h record segments. Each segment length in this case approximates the duration of a single, wind-generated inertial event (c.f. Figs. 4 and 5). Consequently, a given spectral estimate that spans the time of a passing storm is representative of the mean kinetic energy in the wind-generated inertial motions for that particular event.

The plots reveal the intermittent nature of the inertial oscillations and the fact that times of significant activity were not necessarily coincident throughout the entire region. The amplitudes and durations of the widespread events of mid-June and mid-August decreased eastward and northward over the sea. For the mid-June event, durations of the large amplitude signals decreased from a maximum of $\sim$11 days at Station Q05 to a minimum of 4 days at Q04 less than 75 km to the east. It appears that the winds of the second storm were in-phase with the inertial current at Station Q05, causing it to accelerate, but out-of-phase with the current at Q04 causing it to decelerate. At stations Q05, Q08, Q04 and H01, the strongest inertial currents were generated by the first storm; at Stations Q03, Q07 and CS01 the currents were strongest following the second storm.

Figure 8. The next three diagrams present the high resolution (clockwise) spectra for selected near-surface records; tidal constituents subtracted, unfiltered. Nyquist frequency = 2 cph; bandwidth = 0.002 cph; degrees of freedom = 4. Vertical bars denote local Coriolis frequency. A/B: First deployment period. C: Second deployment period.



A.
QO3
QO4
QO5
f
X 10^4 $(CMS^{-1})^2$/CPH
0
1
2
3
4
5
6
0.05
0.06
0.07
FREQUENCY , CPH

FIG 8A

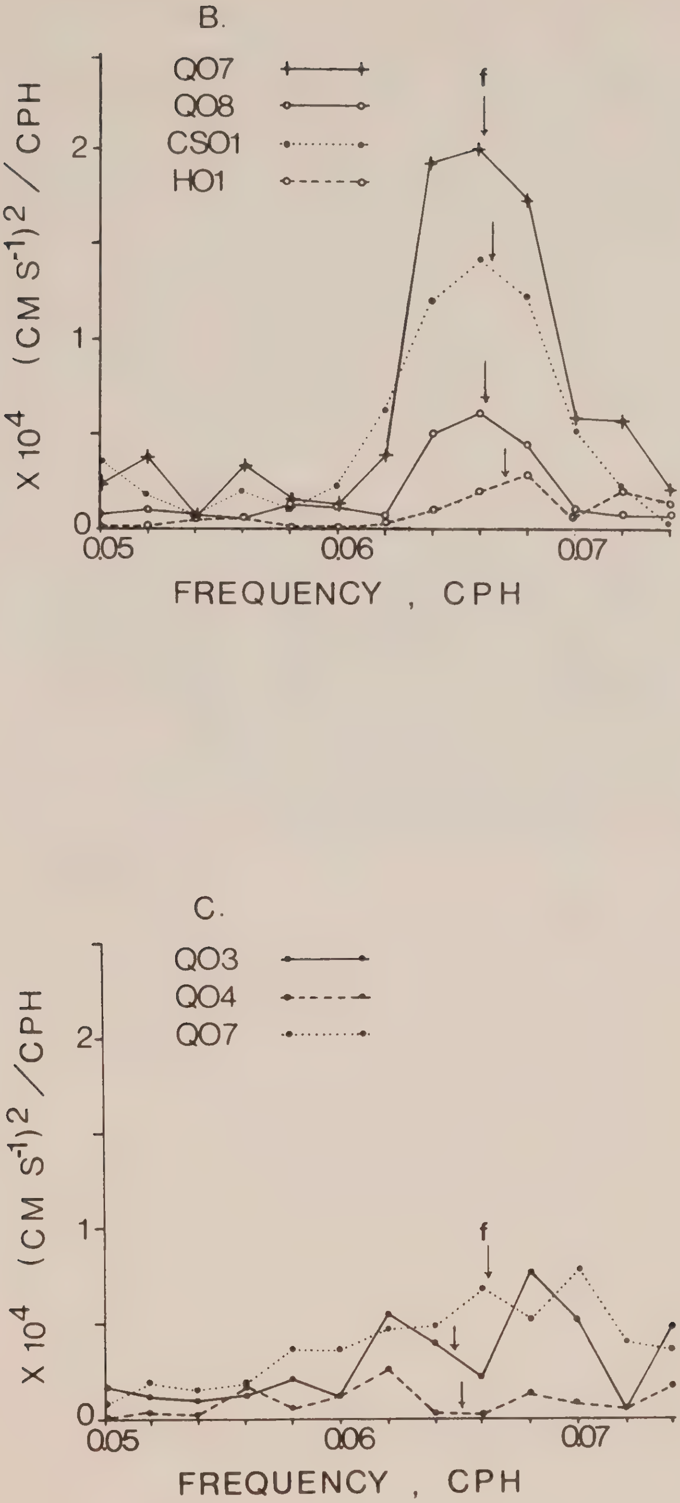

B.
QO7
QO8
CSO1
HO1
f
2
1
0
0.05
0.06
0.07
X 10^4 (CM S^-1)^2 / CPH
FREQUENCY , CPH
C.
QO3
QO4
QO7
f
2
1
0
0.05
0.06
0.07
X 10^4 (CM S^-1)^2 / CPH
FREQUENCY , CPH

FIG. 8B,C

Figure 9. The next two diagrams present the temporal variability of the clockwise rotary spectra at frequency 0.06 cph for the two deployment periods. Each data segment spans 64 hours with 32-hour overlaps between spectra estimates; time of estimate corresponds to mid-point of each segment.

FIG. 9A

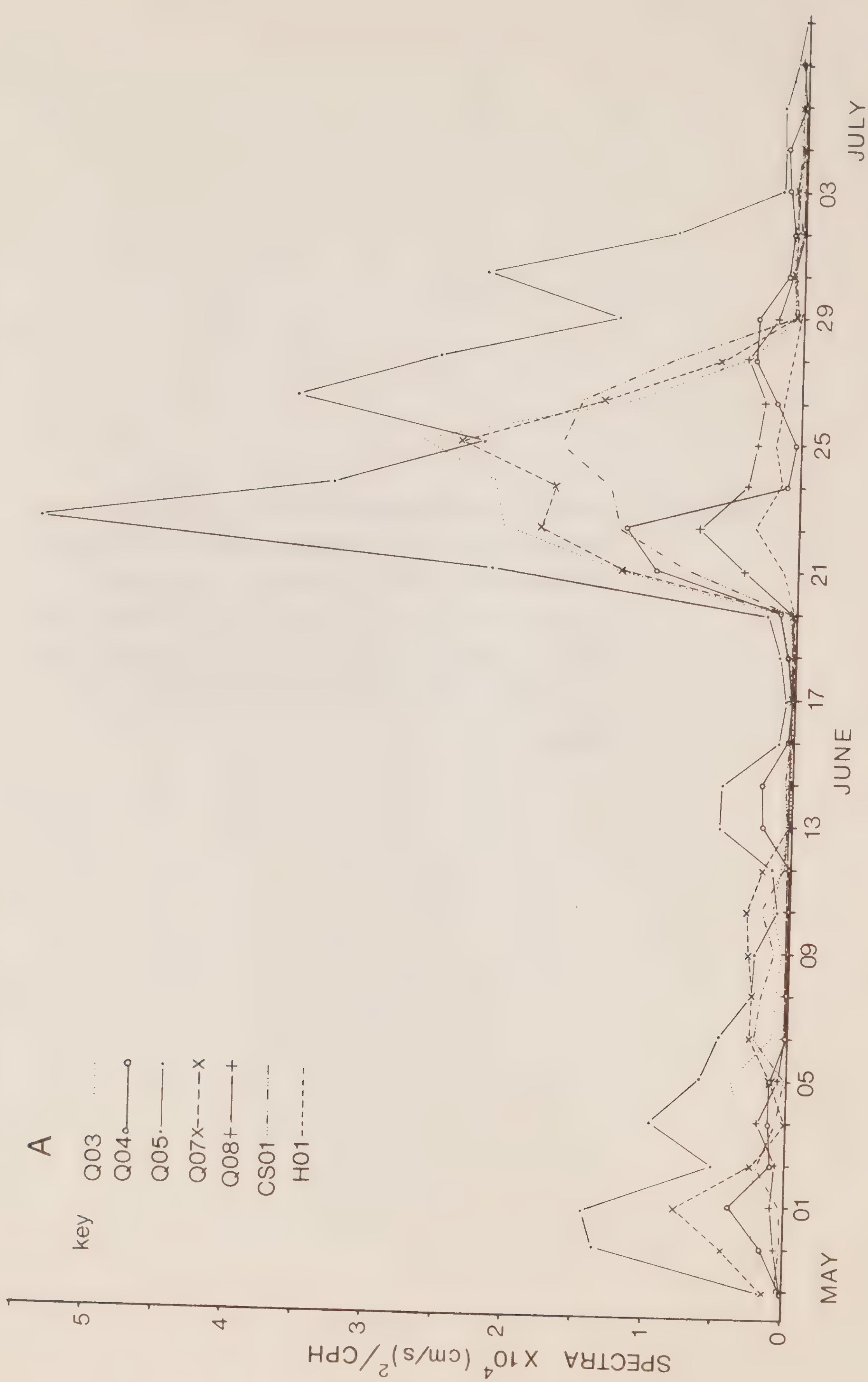
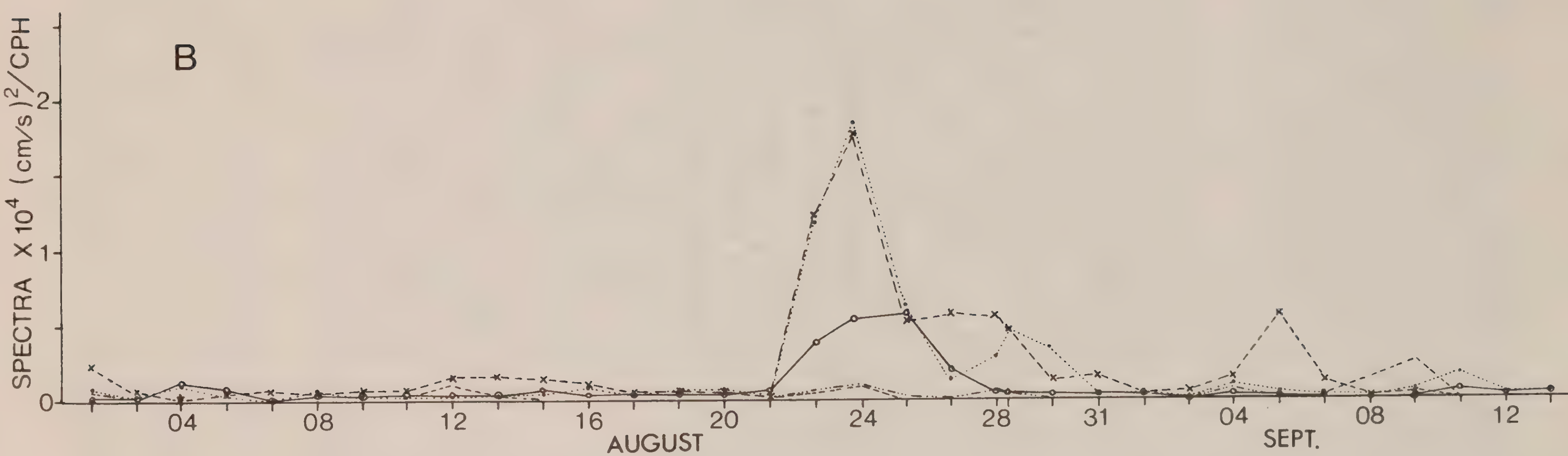

A
key
Q03
Q04
Q05
Q07x
Q08+
CS01
H01
SPECTRA X 10^4 (cm/s)^2/CPH
0
1
2
3
4
5
MAY
01
05
09
13
JUNE
17
21
25
29
03
JULY

FIG.9B


B
SPECTRA X 10^4 (cm/s)^2/CPH
0
1
2
04
08
12
16
20
24
28
31
04
08
12
AUGUST
SEPT.

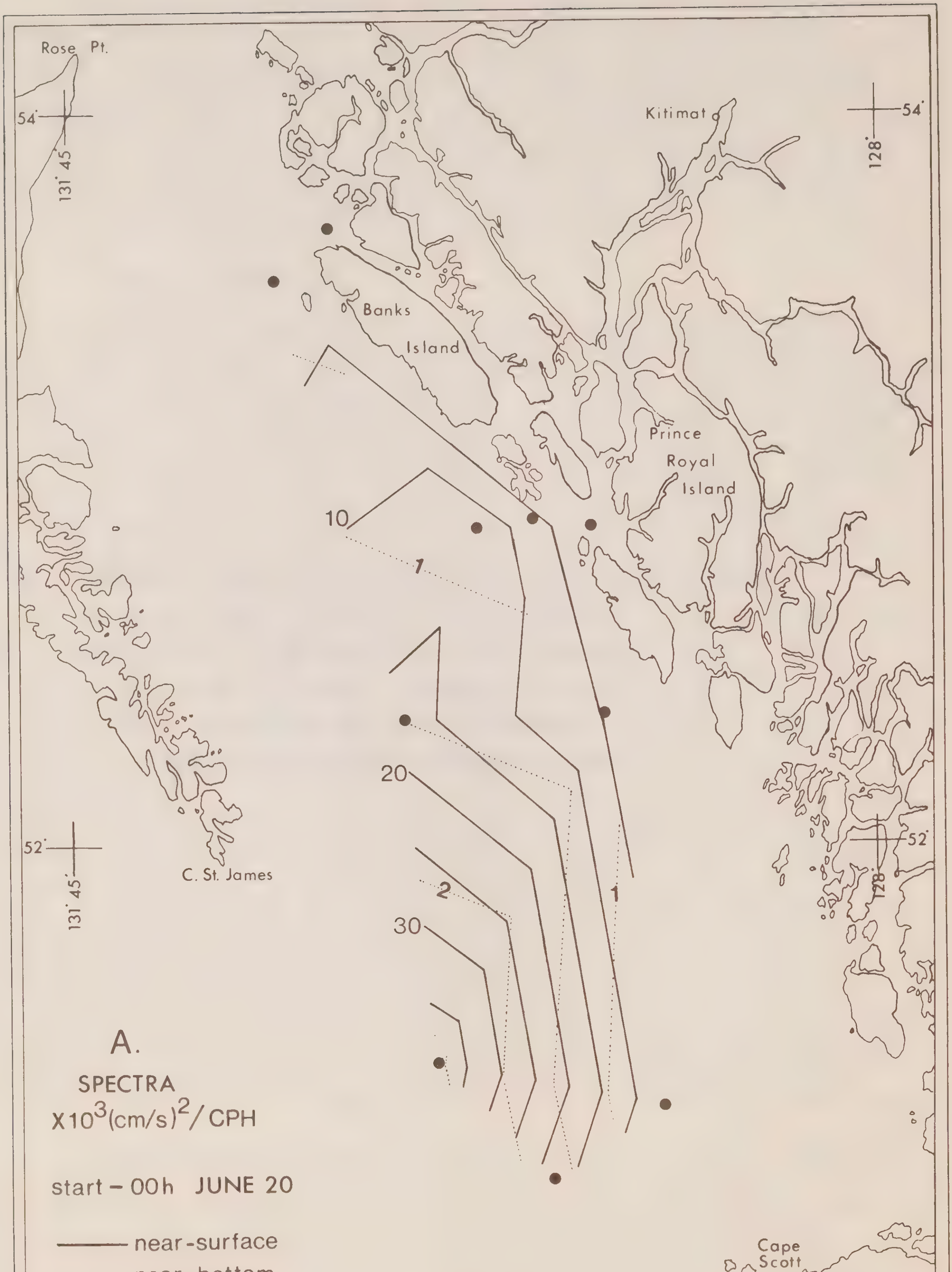
The largest oscillations for the mid-August event occurred at the more western Stations Q07 and Q03. In all instances there was a marked decrease in the spectra prior to the arrival of the third wind system a few days later. A noteworthy result is that the initial signal at CS01 was of lower amplitude than that at the more protected mooring CS02, 40 km to the east, whereas for the second storm, there was a substantial inertial oscillation at CS01 and a negligible one at CS02. The occurrence of larger oscillations at CS02 and CS01 appeared at other times during the second deployment period (Fig. 5b) and was possibly related to differences in the local winds, mean currents or vertical density structures.

Spatial distribution

Spatial distributions of the clockwise rotary spectra within the inertial band for two major event periods are presented in Figs. 10a,b. Analysis segments span 10.7 days (256 h) and for a given period have identical start times, roughly ½ day before the onset of the event. The above patterns closely resemble those based on shorter 64-h segments for the times of the major events and indicate that an inertial wave field generated by one storm generally reinforced that of the preceding storm in the sequence. Except for comparatively large values at Station CS01, inertial current amplitudes diminished sharply toward the mainland coast. Because of the small depth span (7-24 m) of the near-surface meters in the open portion of the region, we assume that this eastward attenuation was due in part to horizontal differences in amplitudes of the surface-generated currents. Nevertheless, depth-dependent differences resulting from differences in depth of the near-surface current meters would also have been an important effect. Results of Kundu (1976) and Pollard (1980) for instance showed marked amplitude attenuation within the upper 20 m. However, in those studies the surface layer was highly structured with peak N(z) at less than 15-20 m depth, which was not the case here. Oceanographic surveys within the region in July 1977, about one month after the mid-June event and near the time of the seasonal maximum surface heating, when the upper zone has greatest vertical structure, revealed a weakly stratified upper layer of 20-30 m depth (Fig. 11a,b). Deeper surface layer depths were observed in May and September. Presumably, therefore, the top current meters were simultaneously in, or close to the base of, an upper layer of near-uniform density during the June event. This notion is supported by the small variations in salinity and temperature recorded by near-surface current meters around the time of the event (Fig. 12), by the absence of any consistent dependence of kinetic energy on depth (Fig. 13) and by high coherences between stations during the major events (c.f. Section 6). For such weakly stratified surface waters, we would expect inertial wave kinetic energies to have been roughly uniform with depth (e.g. Pollard, 1970) and differences in amplitude to have resulted mainly from horizontal variations in the wind stress and depth of the surface mixed layer.

During the mid-August event, the surface waters were considerably more structured. However, this was partly offset by the reduced span (10-18 m) of the near-surface current meters within the exposed sector of the region. With regard to Fig. 12, we note that the start times of major inertial events coincided with a sharp attenuation of salinity and temperature fluctuations in the upper layer. It seems that prior to an event, these fluctuations were large due to tidal advection of spatially structured surface waters whereas immediately after passage of a storm, smaller fluctuations

Figure 10. The next two diagrams present the horizontal distributions of clockwise rotary spectra at frequency 0.06 cph, based on 256-hour current velocity segments. Bandwidth = 0.02 cph. A: Mid-June event. B: Mid-August event (weak near-bottom spectra not plotted).



Rose Pt.
54°
131° 45'
Kitimat
54°
128°
Banks
Island
Prince
Royal
Island
10
1
20
52°
C. St. James
131° 45'
2
30
1
52°
128°
A.
SPECTRA
X10^3(cm/s)^2/CPH
start – 00h JUNE 20
near-surface
near-bottom
Cape
Scott
Vancouver
Island

FIG 10

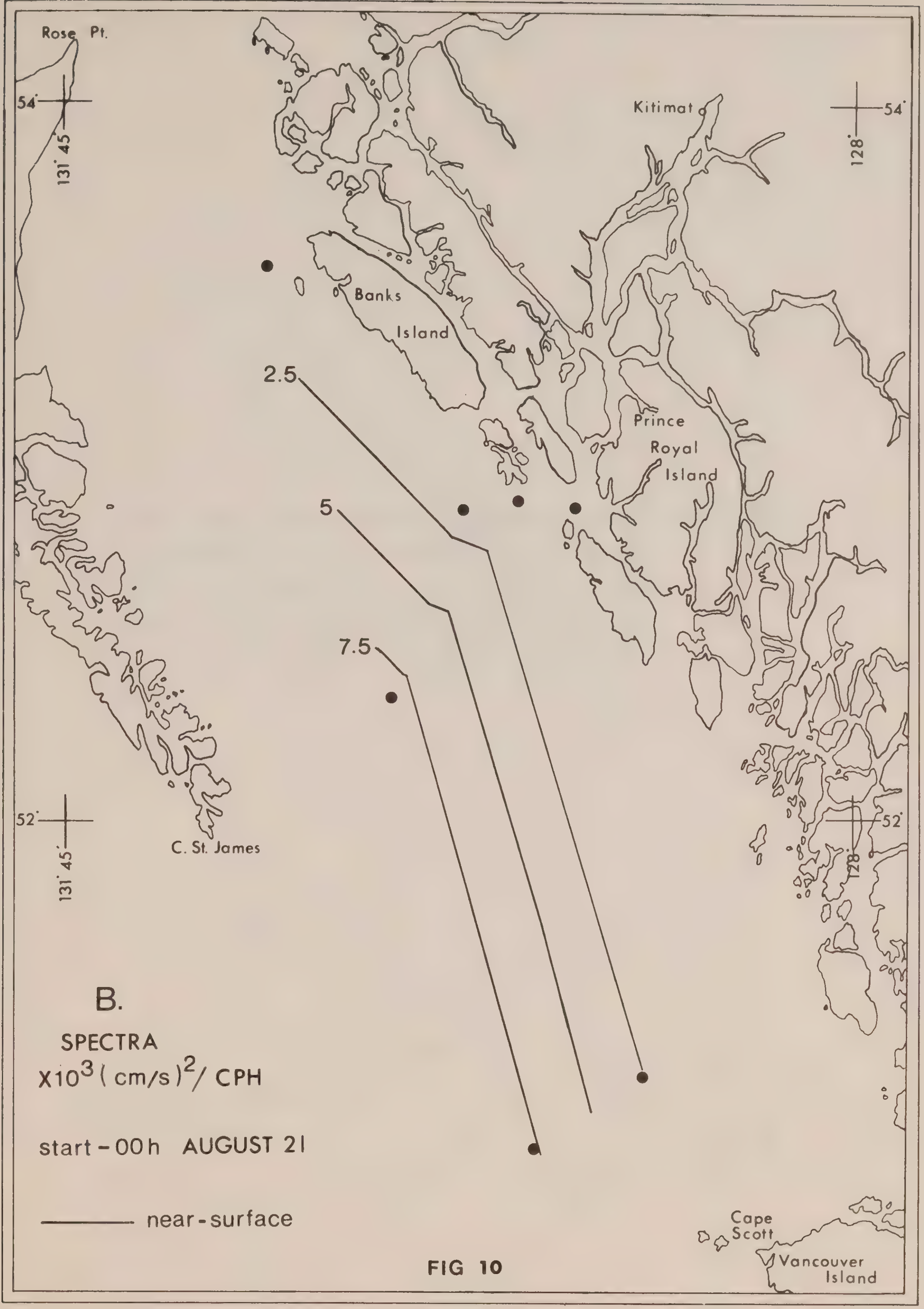

Rose Pt.
54°
131° 45'
Kitimat
54°
128°
Banks
Island
2.5
Prince
Royal
Island
5
7.5
52°
C. St. James
131° 45'
52°
128°
B.
SPECTRA
X10^3 (cm/s)^2/ CPH
start - 00h AUGUST 21
near - surface
Cape
Scott
Vancouver
Island

FIG 10

Figure 11A. Depth of weakly stratified upper layer from 17-19 July as interpolated from a grid of 23 CTD stations covering Queen Charlotte Sound and Hecate Strait (see Thomson et al, 1981). Layer depth roughly corresponds to depth of maximum N(Z).

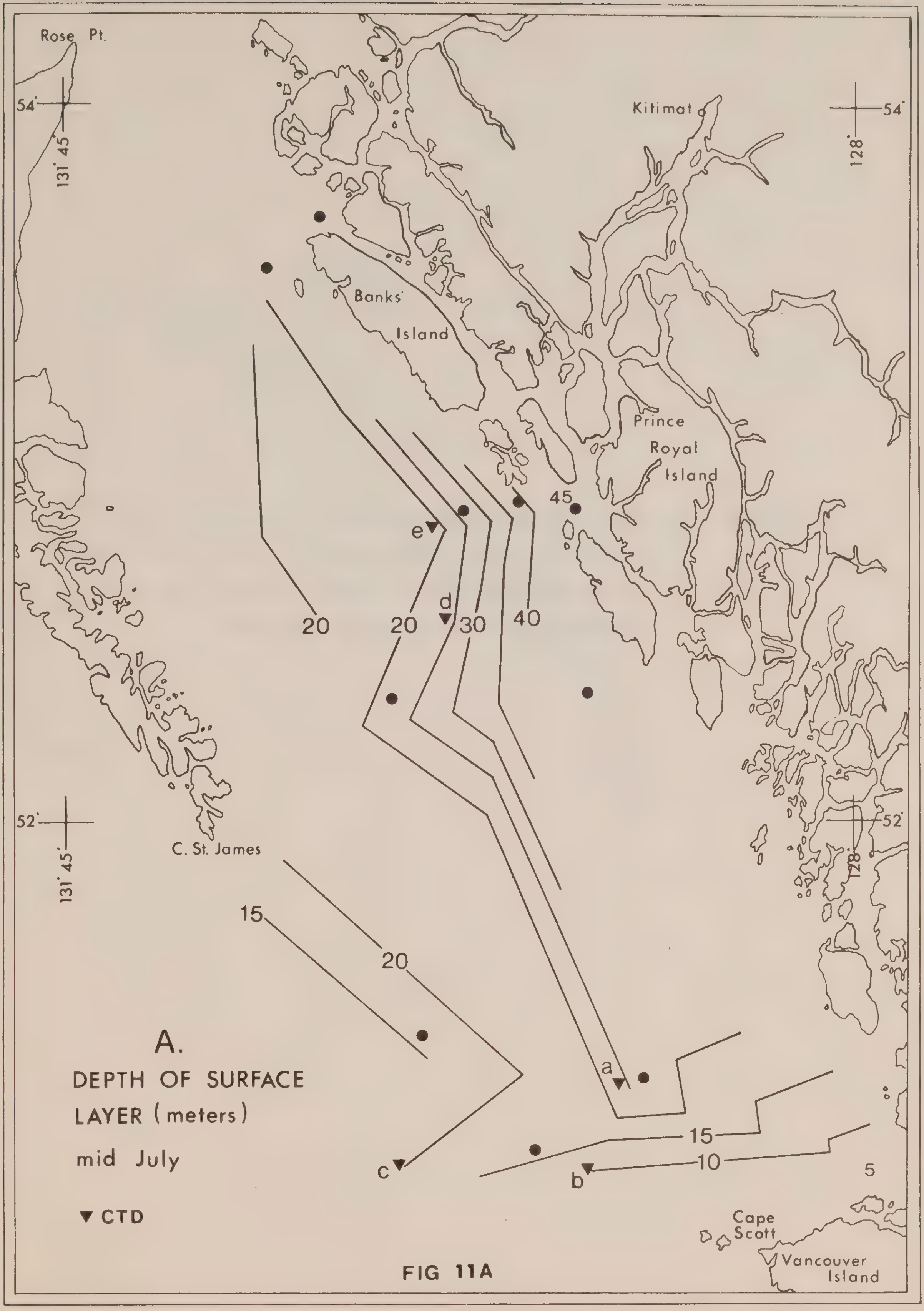

Rose Pt.
54°
131° 45'
Kitimat
54°
128°
Banks Island
Prince Royal Island
45
e
20
20
d
30
40
52°
131° 45'
C. St. James
15
20
52°
128°
a
15
10
5
c
b
Cape Scott
Vancouver Island
A.
DEPTH OF SURFACE LAYER (meters)
mid July
▼ CTD

FIG 11A

Figure 11B. Vertical profiles of density (σ_t) for five CTD locations (a-e) shown in Fig. 11A. Values have been averaged over 1 m and, except near the surface, plotted at 10 m intervals.

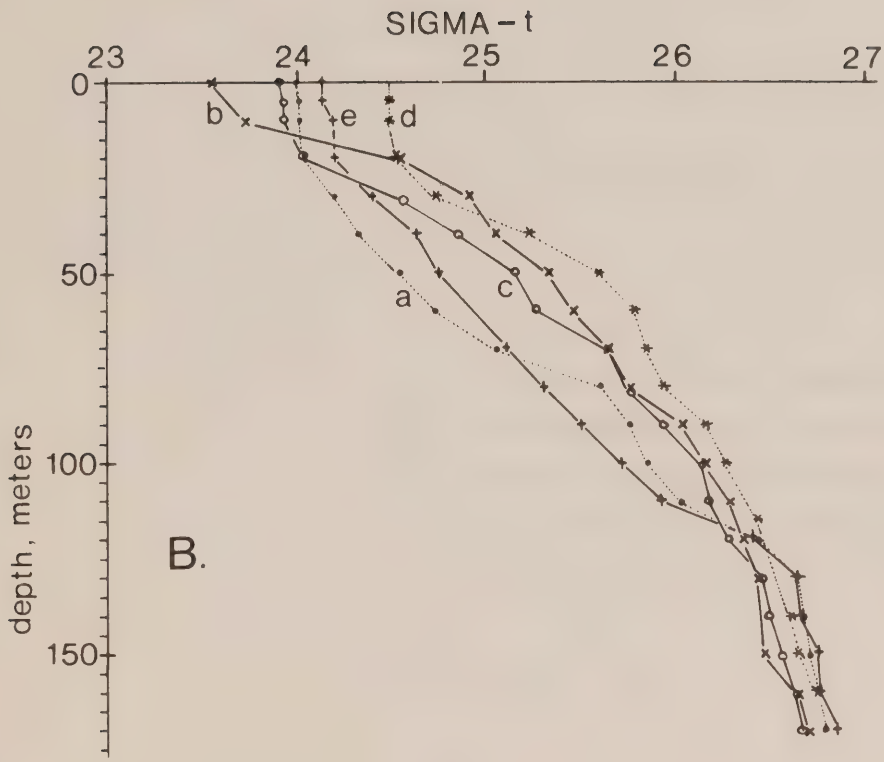
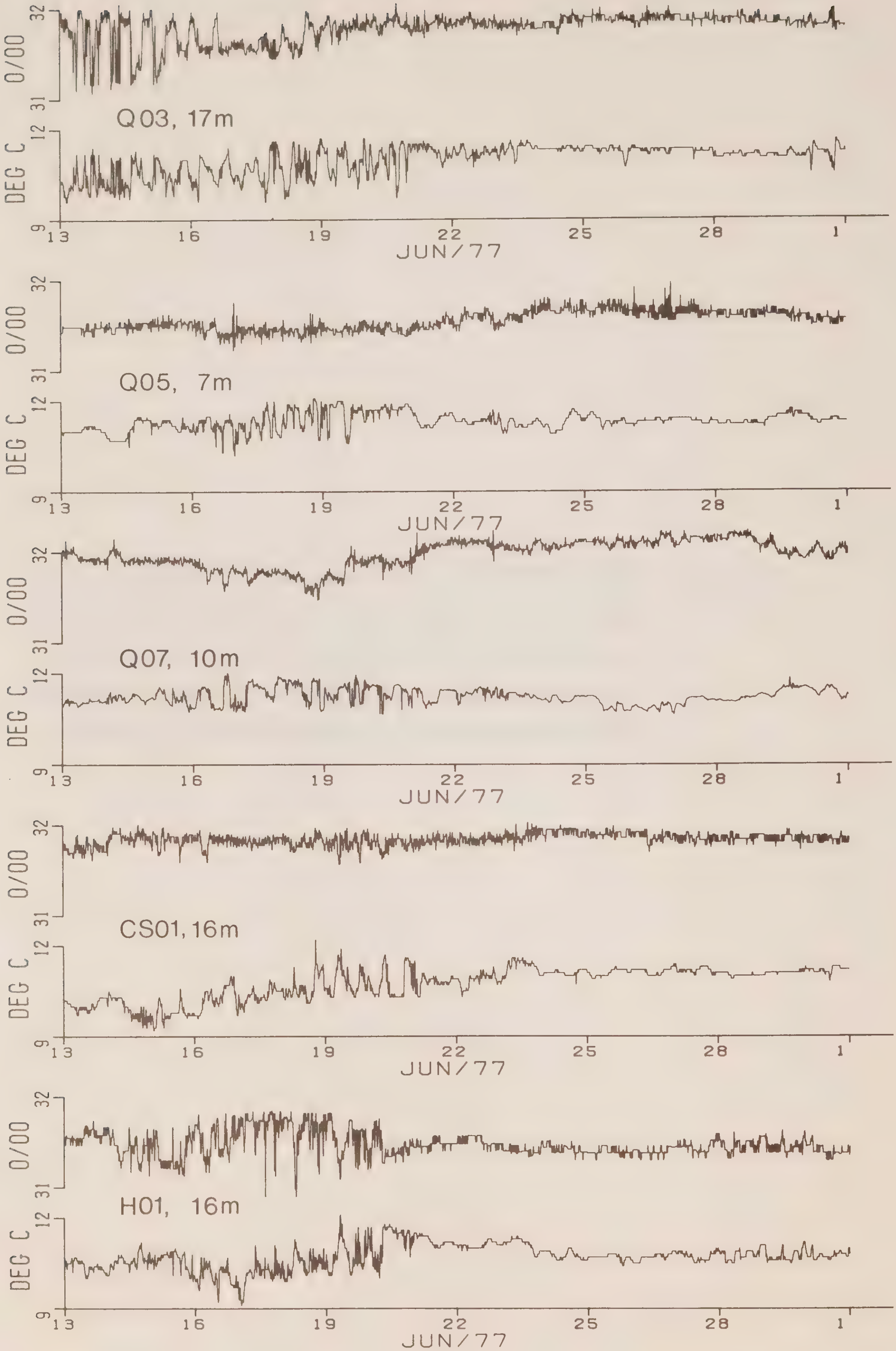


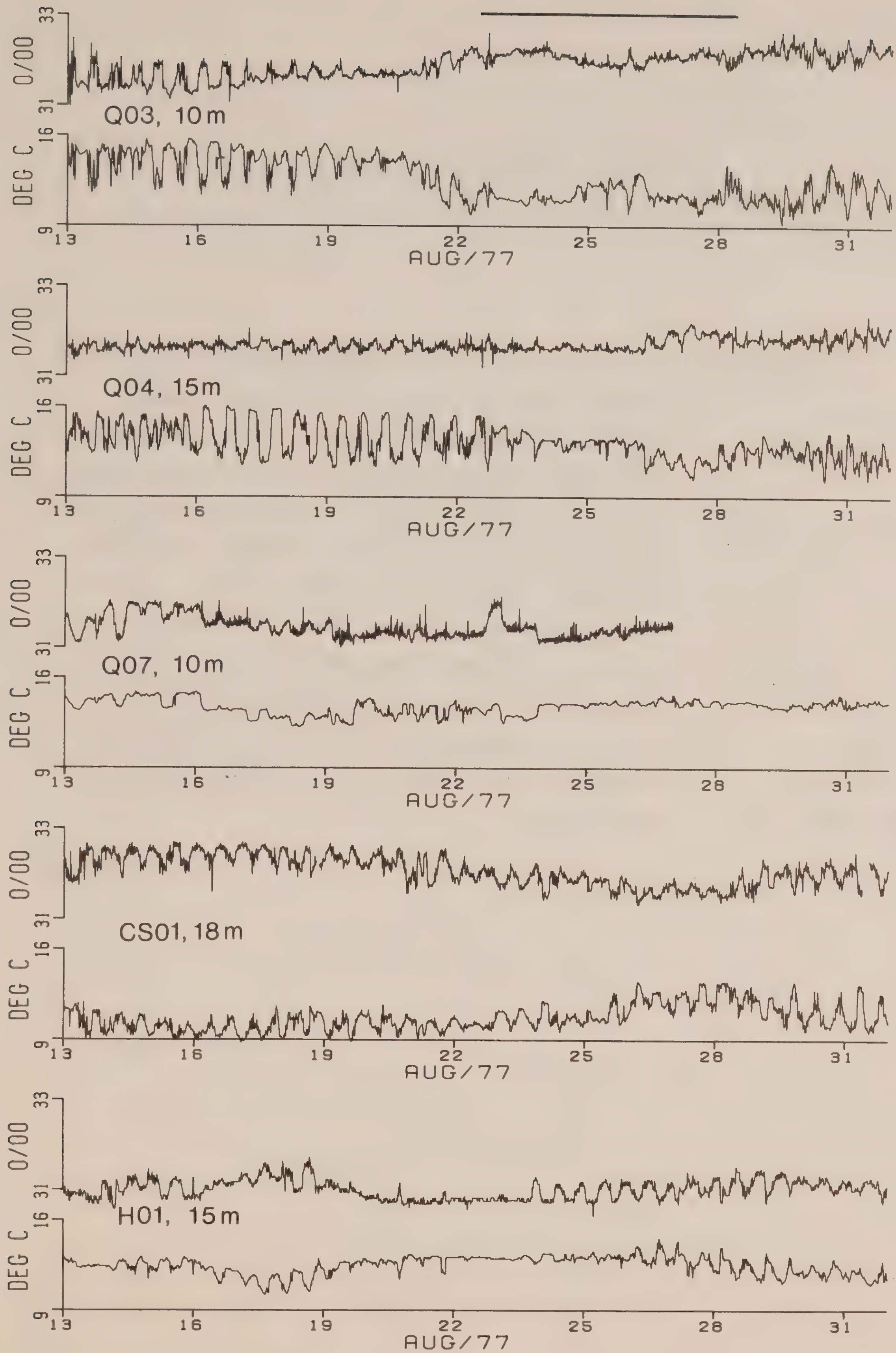
FIG. 11B

Figure 12. The following two figures show the near-surface salinity and temperature fluctuations at selected current meter locations before and during times of major inertial oscillation events. Horizontal bars denote times of strong inertial currents.



32
0/00
31
Q03, 17m
12
DEG C
9
13
16
19
22
25
28
1
JUN/77
Q05, 7m
Q07, 10m
CS01, 16m
H01, 16m

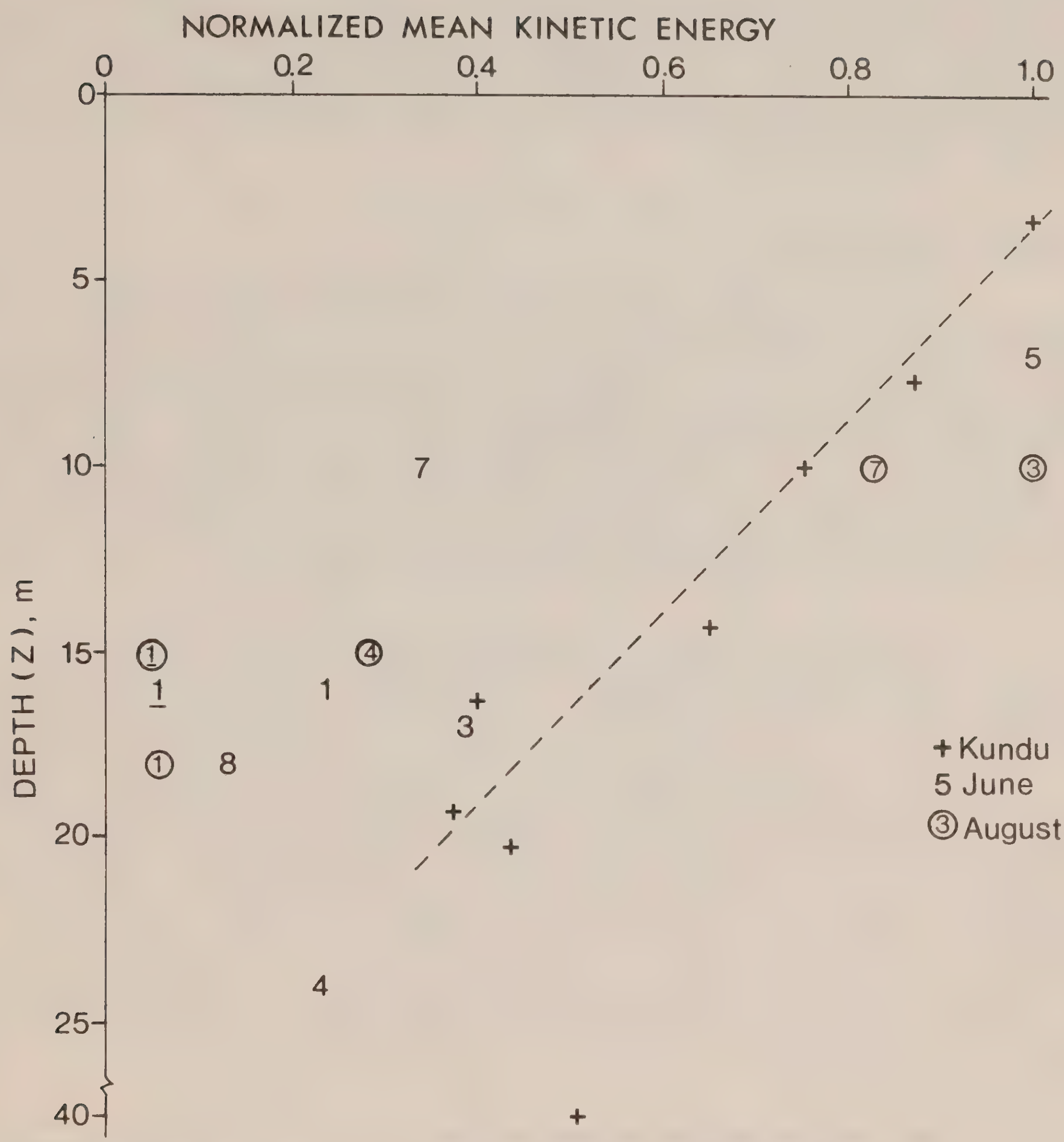
FIG. 12A



Q03, 10m
Q04, 15m
Q07, 10m
CS01, 18m
H01, 15m
0/00
DEG C
33
31
16
9
13
16
19
22
25
28
31
AUG/77

FIG. 12 B

Figure 13. Normalized mean kinetic energy (KE*) versus depth. Numbers refer to near-surface kinetic energies (spectrum x bandwidth) derived from spectra for mid-June event (uncircled numbers) and mid-August event (circled numbers). Frequency band 0.05-0.07 cph with 0.02 cph bandwidth. Numbers 3-8 refer to Stations Q03-Q08; 1 = CS01; 1 = H01. Dashed line is regression curve, KE* = -0.03883 Z + 1.1405, for values from table 1, Kundu (1976). The best fit line to the estimates for the outer locations (Q03, 04, 05) for the mid-June event have approximately the same slope as the dashed line.



NORMALIZED MEAN KINETIC ENERGY
0
0.2
0.4
0.6
0.8
1.0
DEPTH (Z), m
0
5
10
15
20
25
40
+ Kundu
5 June
③ August

FIG 13

ensued because of greater spatial homogeneity and/or deepening of the surface layer, possibly as a result of enhanced vertical mixing by inertial current induced vertical shears.

The spatial attenuations displayed in Fig. 10a were coincident with eastward weakening and decreased veering of the winds (Fig. 14). The diminished strength of the winds accompanied a general weakening of the cyclones and accompanying fronts at the coast while the reduced rotation of the wind vector was caused by topographic constraints of the mainland coast. As discussed in Section 9, the effect of the land on the orientation of the winds may have been largely responsible for the alteration of inertial current amplitudes within the sea.

5. COMPLEX DEMODULATION

Standard complex demodulation was applied to the bandpass filtered current records to show the amplitudes and phases of inertial current vectors as functions of time. (This of course has the effect of spreading the signal still further in the time domain.) Figure 15 presents representative values based on local inertial frequencies and record lengths of two inertial periods. Where the measured current vector lags the reference (inertial) current vector, the phase increases with time (rotation rates less than the local inertial frequency); where this vector leads the local reference vector, the phase decreases with time. Complex demodulation of the oceanic winds at near-inertial frequency is presented in Fig. 16.

A difficulty with the above type of presentation is that the difference between the observed frequency and the reference (inertial) frequency is not immediately obvious. Also, owing to inherent ambiguities, phases tend to be erratic especially at times of small amplitude currents. More importantly, the analysis assumes circularly polarized motions whereas they are usually somewhat elliptical (c.f. Section 7). Therefore, we have taken a second approach in which the observed times between three successive zero-crossings of the bandpass filtered record determines the frequency appropriate to each velocity component for a particular cycle. (The program searches for consecutive zero-crossings in the u component, then shifts forward ¼ period to search for the corresponding zero-crossings for the v component). The amplitude $A = (v_2u_1 - v_1u_2)^{\frac{1}{2}}$, where $u = u_1\cos\Theta + u_2\sin\Theta$, $v = v_1\cos\Theta' + v_2\sin\Theta'$; Θ,Θ' are the phases according to the zero-crossings. Fourier coefficients for v are based on the data segment with the same start time as the u component.

The amplitudes from either method are nearly identical, whereas the second more clearly shows the variation of frequency with time (Fig. 17a-c). Subinertial frequencies were common occurrences at most locations and were especially prevalent at Station Q04. Also, the onset of the major inertial events at Stations Q03, Q04, CS01 and Q08 were immediately preceded by subinertial oscillations whereas at Stations Q05 and Q07 frequencies were generally above f. In the former cases, the frequency of the current oscillations commonly increased from below to above the local inertial frequency following peak amplitude. The amplitudes in Fig. 17 reveal comparatively high background levels of inertial current activity within the coastal sea which, like the amplitudes during the major events, diminished toward the mainland coast.

Figure 14. Time lag and magnitude of frontal winds (rapid veering of southeast winds) for first major storm of the mid-June event based on single oceanic and six shore-based anemometer stations (triangles). Lag (——) is in hours relative to 00h, June 21, 1977; wind speed (---) at time of wind veering is in ms^{-1}. Except for Sandspit and Cape St. James, the latter speeds closely corresponded to the maximum wind speed of the storm. Maximum wind speed at Sandspit was 13 m s^{-1}, at 1200 h; at Cape St. James, 20 m s^{-1} at 0900 h.

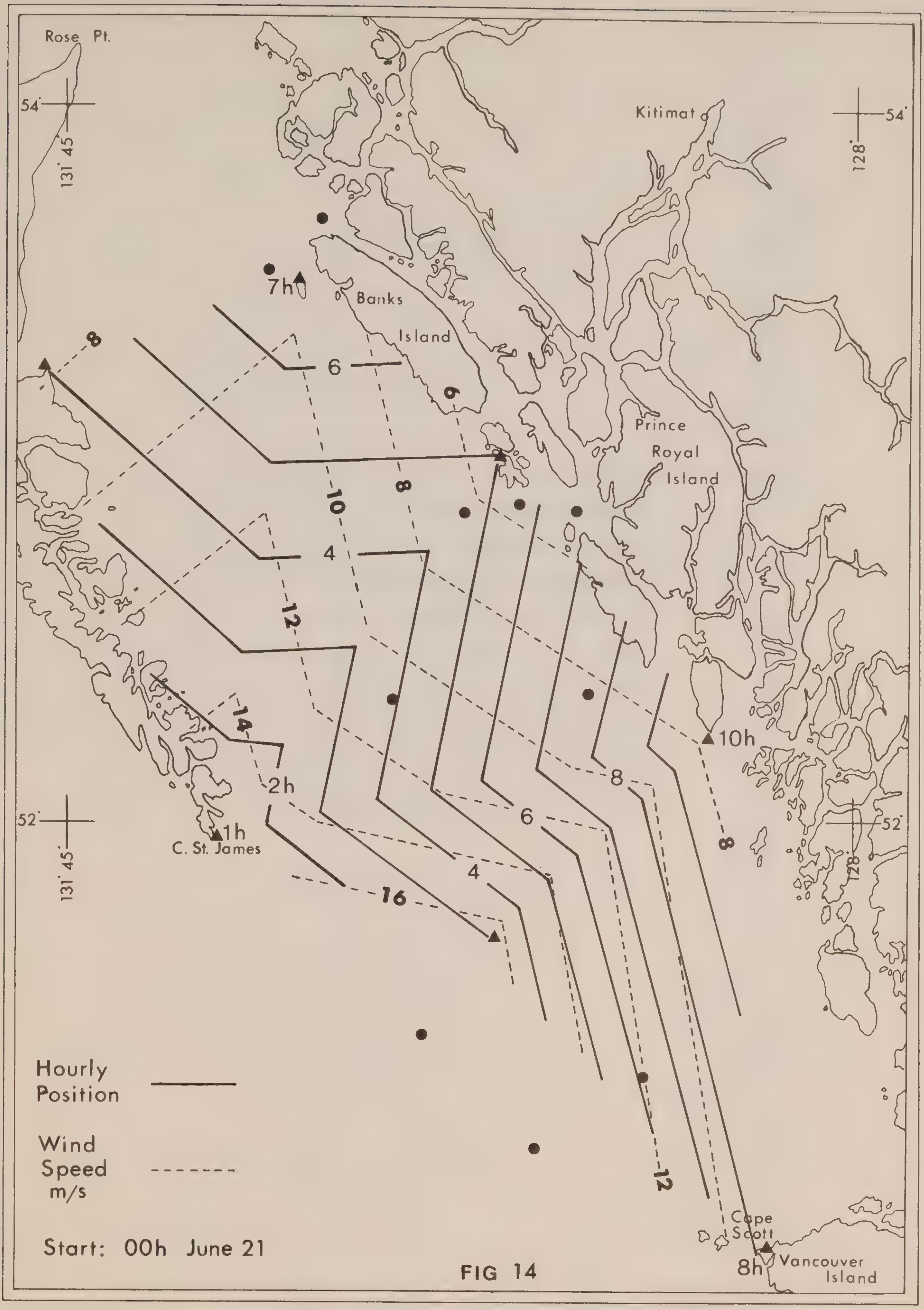

Rose Pt.
54°
131°45
Kitimat
54°
128°
7h
Banks
Island
6
6
8
Prince
Royal
Island
10
8
4
12
14
10h
2h
8
6
8
52°
1h
C. St. James
52°
131°45
128°
4
16
Hourly
Position
Wind
Speed
m/s
12
Cape
Scott
8h
Vancouver
Island
Start: 00h June 21

FIG 14

Figure 15. Complex demodulation of near-surface inertial oscillations. Amplitudes and phases of band-pass filtered currents are determined from a least squares fit of a clockwise rotary vector at 15.38 h period to the observed velocity vector; each set of estimates uses two inertial periods (30.77 h) of data and steps one period forward for each subsequent calculation. Where the phase increases with time the inertial period is less than the local inertial period and vice versa.

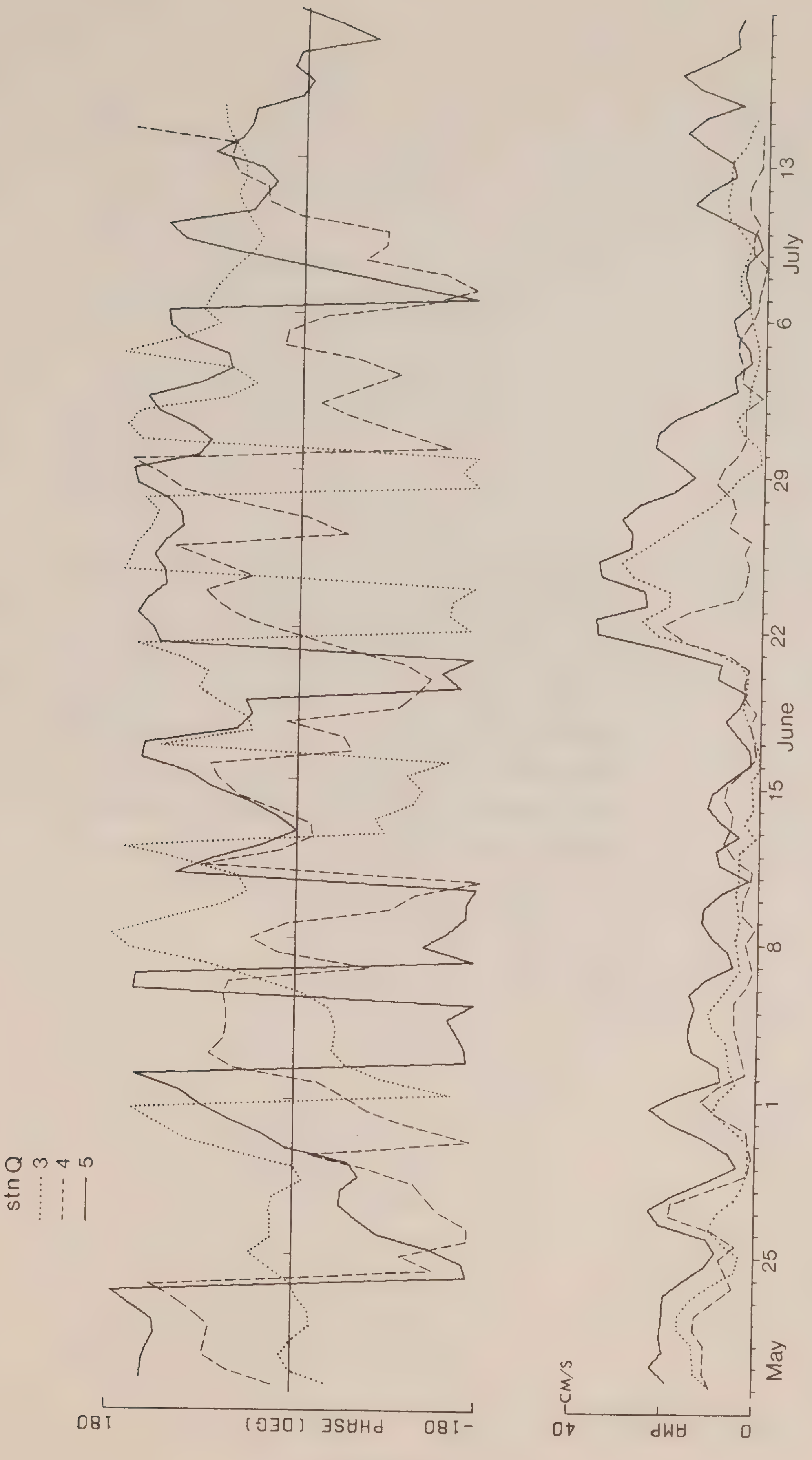

stnQ
3
4
5
180
PHASE (DEG)
-180
40
CM/S
AMP
0
May
25
1
8
15
June
22
29
6
July
13

FIG. 15

Figure 16. Complex demodulation of oceanic wind record. Analysis procedure is identical to that in Fig. 15 and is based on clockwise rotating wind vector of 15.38 h period. Note that only for mid-June event, starting around 21 June, does the phase remain relatively constant indicating a wind rotation rate comparable with the rotation rate of the inertial current vector.

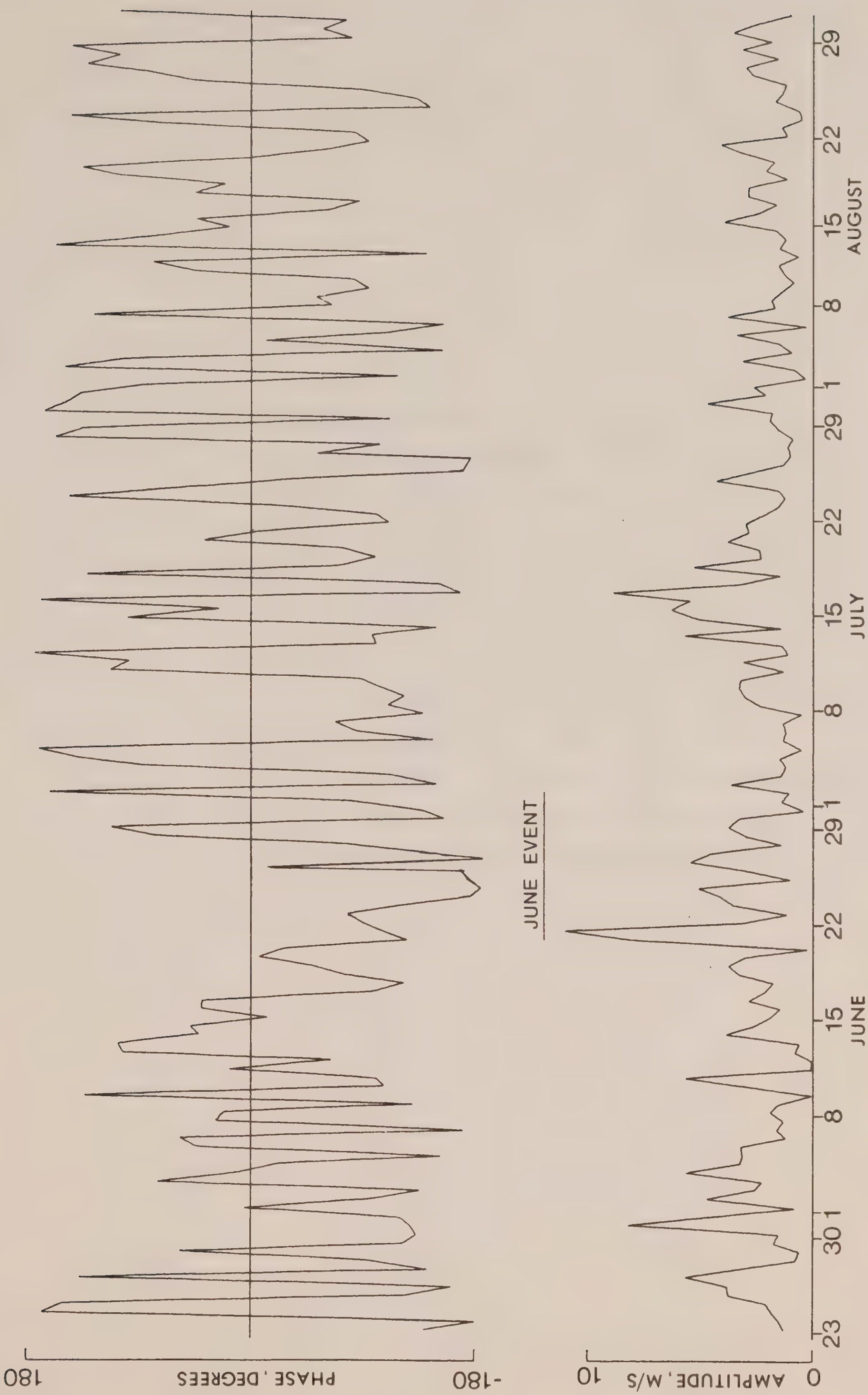

180
PHASE, DEGREES
-180
10
AMPLITUDE, M/S
0
JUNE EVENT
23
30
1
8
15
22
29
1
8
15
22
29
1
8
15
22
29
JUNE
JULY
AUGUST

FIG. 16

Figure 17. The following three plots present results for a modified complex demodulation of near-surface inertial oscillations. Method assumes clockwise rotation of current vector and derives oscillation period from three consecutive zero-crossings of the band-pass filtered (tidal constituent-removed) current records. Frequencies for the north-south (N-S) and east-west (E-W) velocity components are compared in the plots to the local inertial frequency ($\sim$0.065 - 0.066 cph) represented by the horizontal axes. A and B are for the first deployment period, C for the second deployment period.

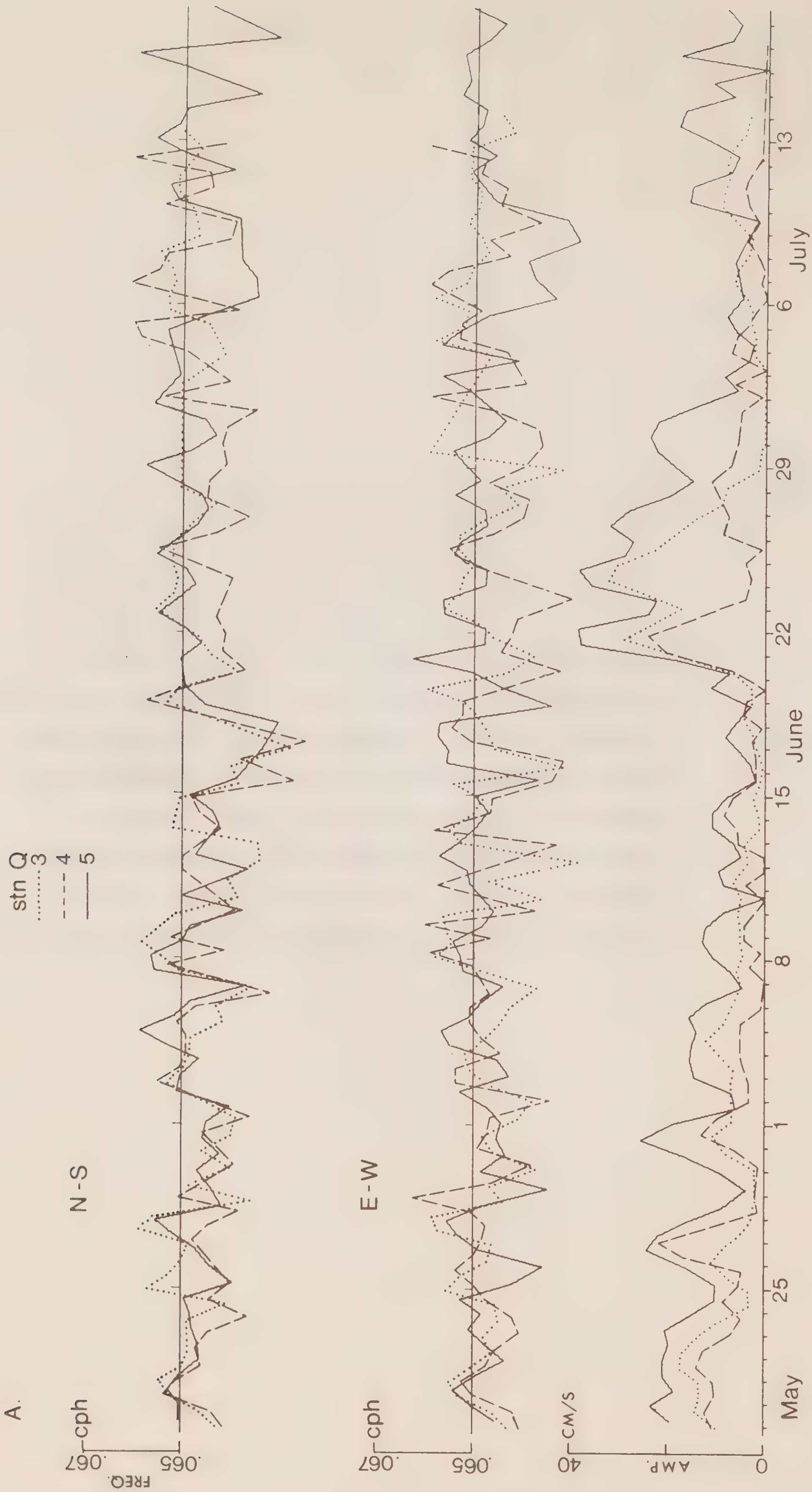

A.
N-S
E-W
stn Q
3
4
5
cph
.067
.065
FREQ.
CM/S
40
AMP.
0
May
25
1
8
15
June
22
29
6
July
13

FIG. 17A

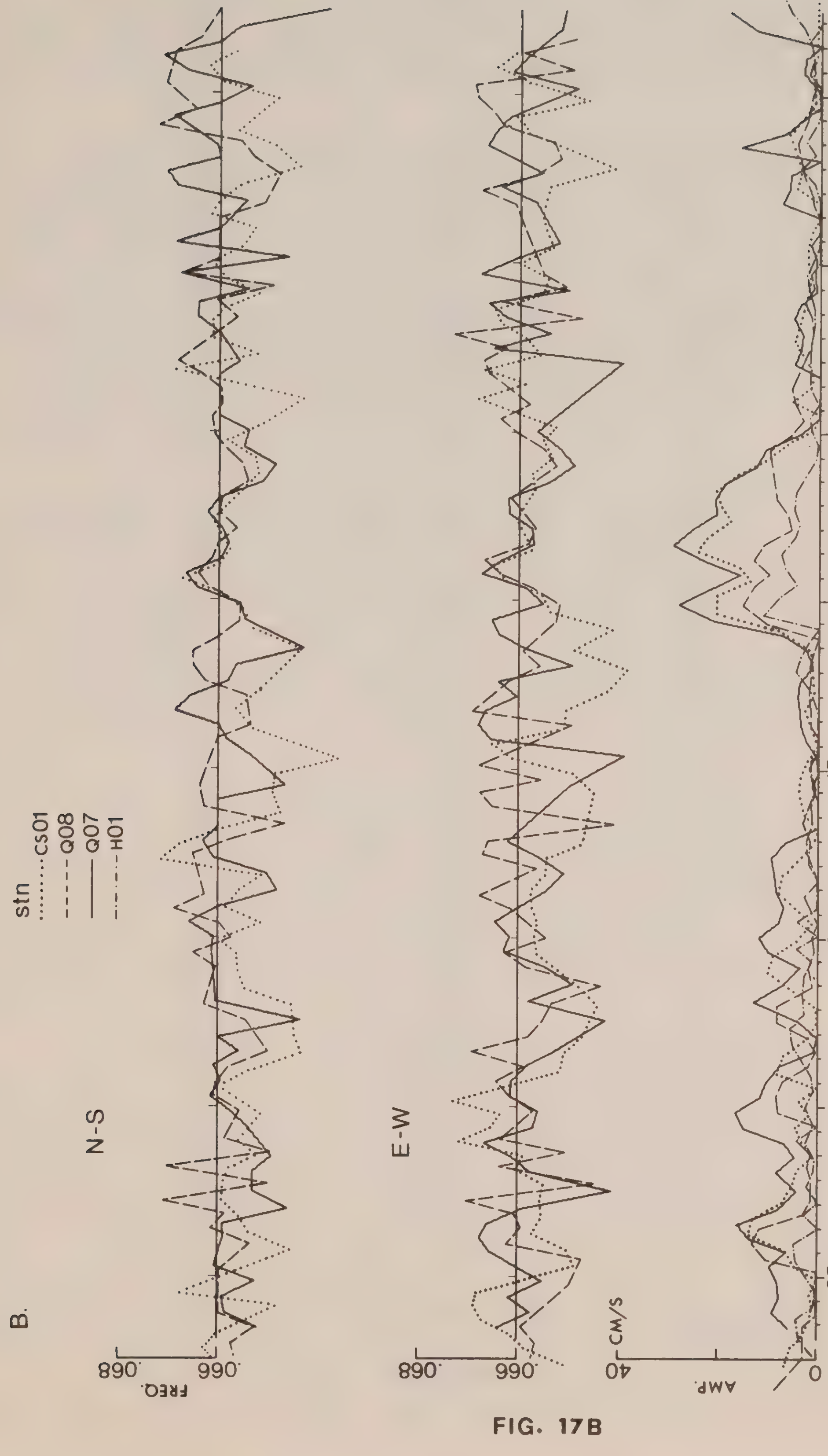

B.
stn
CS01
Q08
Q07
H01
N-S
E-W
FREQ.
.068
.066
AMP.
40
CM/S
0
25
1
8
15
June
22
29
6
July
13

FIG. 17B

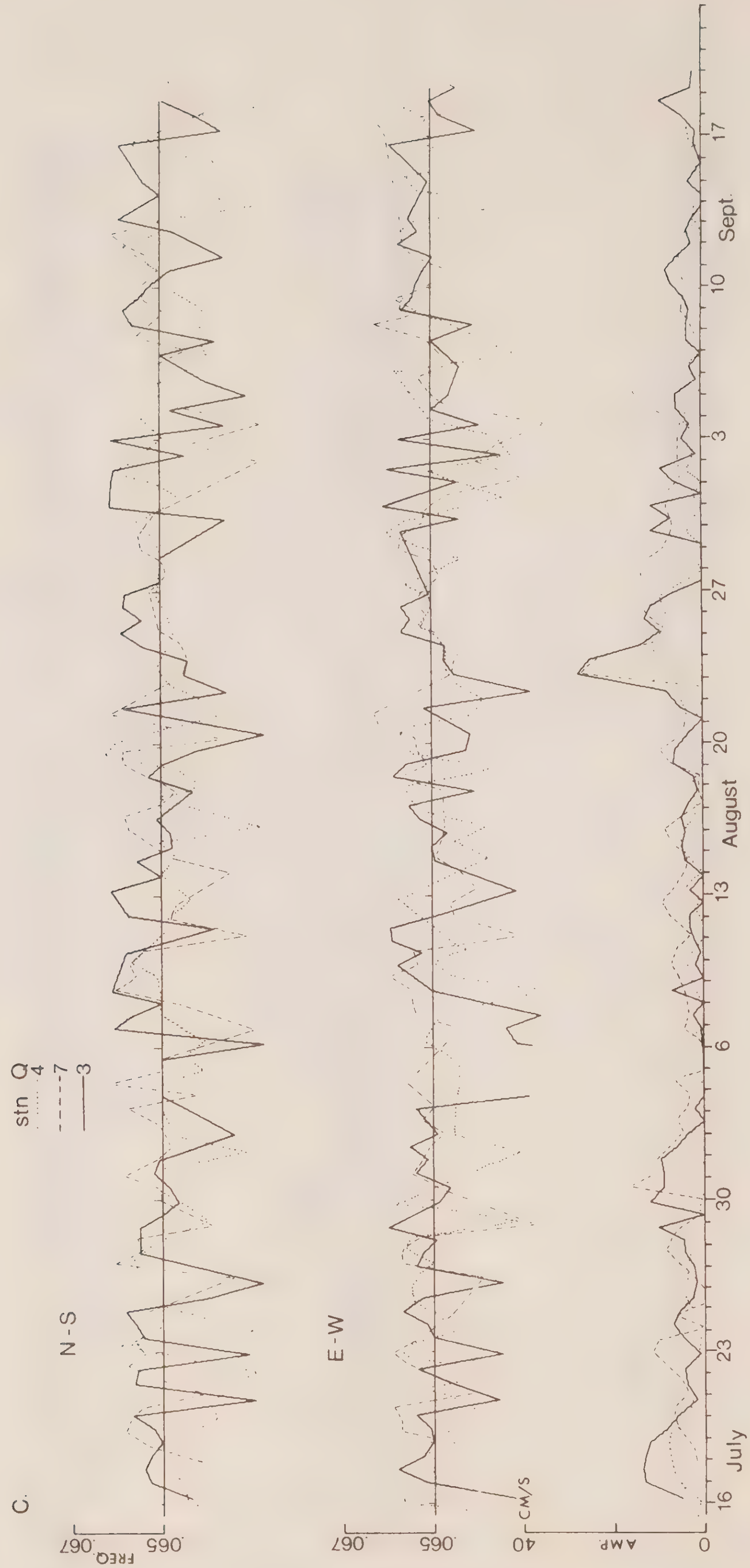

C.
N-S
E-W
stn Q
4
7
3
FREQ.
.067
.065
CM/S
40
AMP.
0
16
23
30
6
13
20
27
3
10
17
July
August
Sept.

FIG. 17C

6. SPECTRAL COHERENCES AND ADMITTANCES

Horizontal and vertical coherences between clockwise rotary, bandpass filtered currents for the two major inertial event periods are presented in Table 3. Estimates are based on 256-h record segments and have a centre frequency of 0.06 cph (0.02 cph bandwidth) with 10 degrees of freedom.

During the mid-June event, near-surface inertial oscillations within the main region of the sea were coherent to 99% confidence, except for Station Q04 which was coherent with other locations to 95% confidence (Table 3a). Coherences for surface moorings in the coastal channels (CS03, H02) were below the 90% confidence level. In the vertical (Table 3b), only the most seaward stations (Q03, Q05) had significant coherences between top and bottom motions at the inertial frequency (> 95% confidence). However, these coherences are suspect due to the small amplitudes of the near-bottom oscillations. During the mid-August event, the inertial oscillations were horizontally coherent to the 95% level, excluding CS01 which was relatively uncorrelated with the neighbouring locations (Table 3a).

According to these results, near-surface inertial oscillations were highly correlated over almost the entire moored array, a longitudinal distance of over 300 km. These results support the contention by Pollard (1980) that "...the horizontal coherence scale may be significantly larger than the 'few tens of kilometres' repeatedly suggested in the literature...". The comparatively low coherences at Station Q04 during the mid-June event and at Station CS01 during the mid-August event seem to have resulted from local "detuning" of inertial oscillations at these locations by relatively strong (10–20 cm s^{-1}) mean currents. This question is considered in more detail in Section 8.

The relative phases and amplitudes (admittances) of near-surface inertial oscillations for the two widespread event periods are presented in Figs. 18a,b. Data segments again span 256 h with center frequency 0.06 cph and 0.02 cph bandwidth. Values are referred to the surface meter record at Station Q03; possible 360° ambiguities have been eliminated by visual comparison of phases with the bandpass filtered velocity components in Figs. 5a,b. (Phase and amplitude distributions derived for 64-h data segments resemble those in Figs. 18a,b and are not presented.)

In each figure, amplitudes attenuate toward the northeast and closely follow the pattern established by the spectral amplitudes (Section 4). Phases for the mid-June event (Fig. 18a) indicate that the wind-induced signal first began at Q03 and then had a delayed onset over the region in approximately a northeasterly direction. According to the phases of the southern triad of Stations (Q05-Q03-Q04), the signal at Q03 had an effective phase velocity toward 20°T with speed c = 5.1 km h^{-1} (1.4 m s^{-1}) with wavelength λ = 85 km; according to the triad Q03-Q04-Q08, on the other hand, the signal at Q04 was toward 95°T at 5.7 km h^{-1} with λ = 95 km. In the region of the central triads, H01-Q07-Q08 and CS1-Q07-Q08, the signal advance was northeastward (45°T and 60°T, respectively) with respective speeds of 19.4 and 23.9 km h^{-1} and wavelengths of 325 and 400 km. The weak inertial signals within the channels were delayed significantly relative to the exposed coastal locations; from CS01 to CS03 the delay was 6.7 h (c $\simeq$ 5.3 km h^{-1}) and

TABLE 3A. Horizontal coherence matrix for near-surface, clockwise inertial current component for center frequency of 0.06 cph, 0.02 cph bandwidth and 10 degrees of freedom. Values in lower left half of matrix are for the mid-June event (start: 20 June) those in upper right for the mid-August event. Confidence limits: 90% = 0.60; 95% = 0.67; 99% = 0.77.

STATION	Q03	Q04	Q05	Q07	Q08	CS01	CS02	CS03	H01	H02
Q03	1	0.86	-	0.83	-	0.51	0.72	-	0.79	-
Q04	0.64	1	-	0.89	-	0.73	0.83	-	0.74	-
Q05	0.95	0.56	1	-	-	-	-	-	-	-
Q07	0.98	0.67	0.94	1	-	0.58	0.80	-	0.55	-
Q08	0.94	0.74	0.94	0.93	1	-	-	-	-	-
CS01	0.98	0.62	0.96	0.98	0.94	1	0.60	-	0.29	-
CS02	-	-	-	-	-	-	1	-	-	-
CS03	0.60	0.50	0.56	0.57	0.64	0.56	-	1	-	-
H01	0.94	0.67	0.90	0.96	0.90	0.93	-	0.55	1	-
H02	0.59	0.71	0.55	0.60	0.57	0.75	-	0.04	0.66	1

TABLE 3B. Vertical coherences between top and bottom current meters for clockwise inertial current component; center frequency = 0.06 cph, bandwidth = 0.02 cph and degrees of freedom = 10. For mid-June event beginning June 20. Numbers below station are depths (m) to top, bottom current meters.

	STATION					
	Q03 17,160	Q04 24,255	Q05 7,275	Q07 10,330	Q08 18,155	H01 16,155
Coherence	0.69	0.26	0.79	0.56	0.52	0.36

Figure 18. The next two diagrams present plots of the amplitudes and phases of clockwise rotary, near-surface inertial current oscillations relative to Station Q03 at frequency of 0.06 cph (bandwidth = 0.02 cph). Estimates are derived from the complex-valued "inner" admittance, $Z_{i3} = S_{i3}/S_{33}$, where S_{i3} is the cross spectrum between clockwise rotating components (at 0.06 cph) at stations i and 3, and S_{33} is the power spectrum of the clockwise component at station 3. Arrows denote direction of phase propagation derived using phases from triads of stations. Analyse span 256 h of data. A. Mid-June event, beginning 20 June. B. Mid-August event, beginning 21 August.

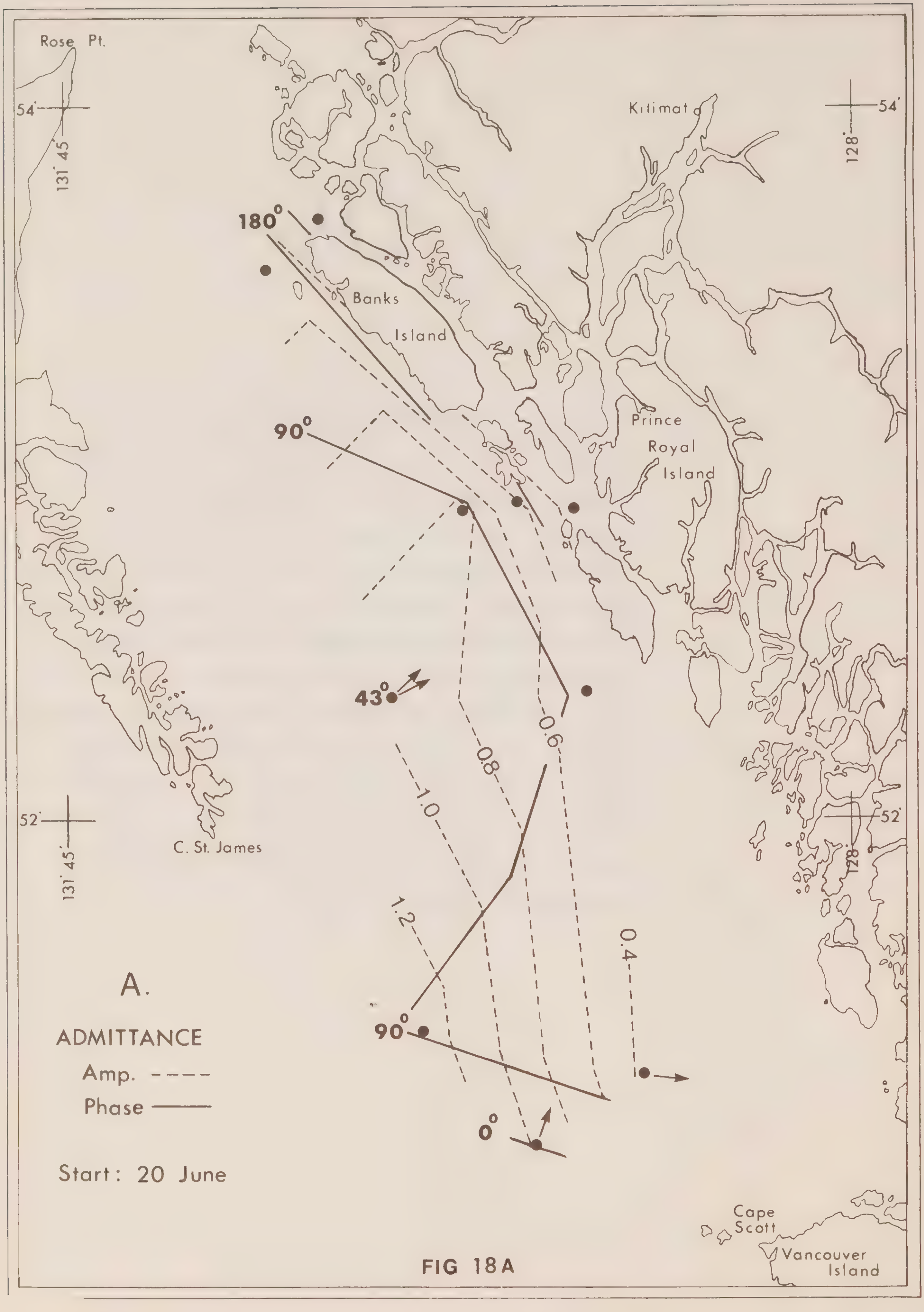
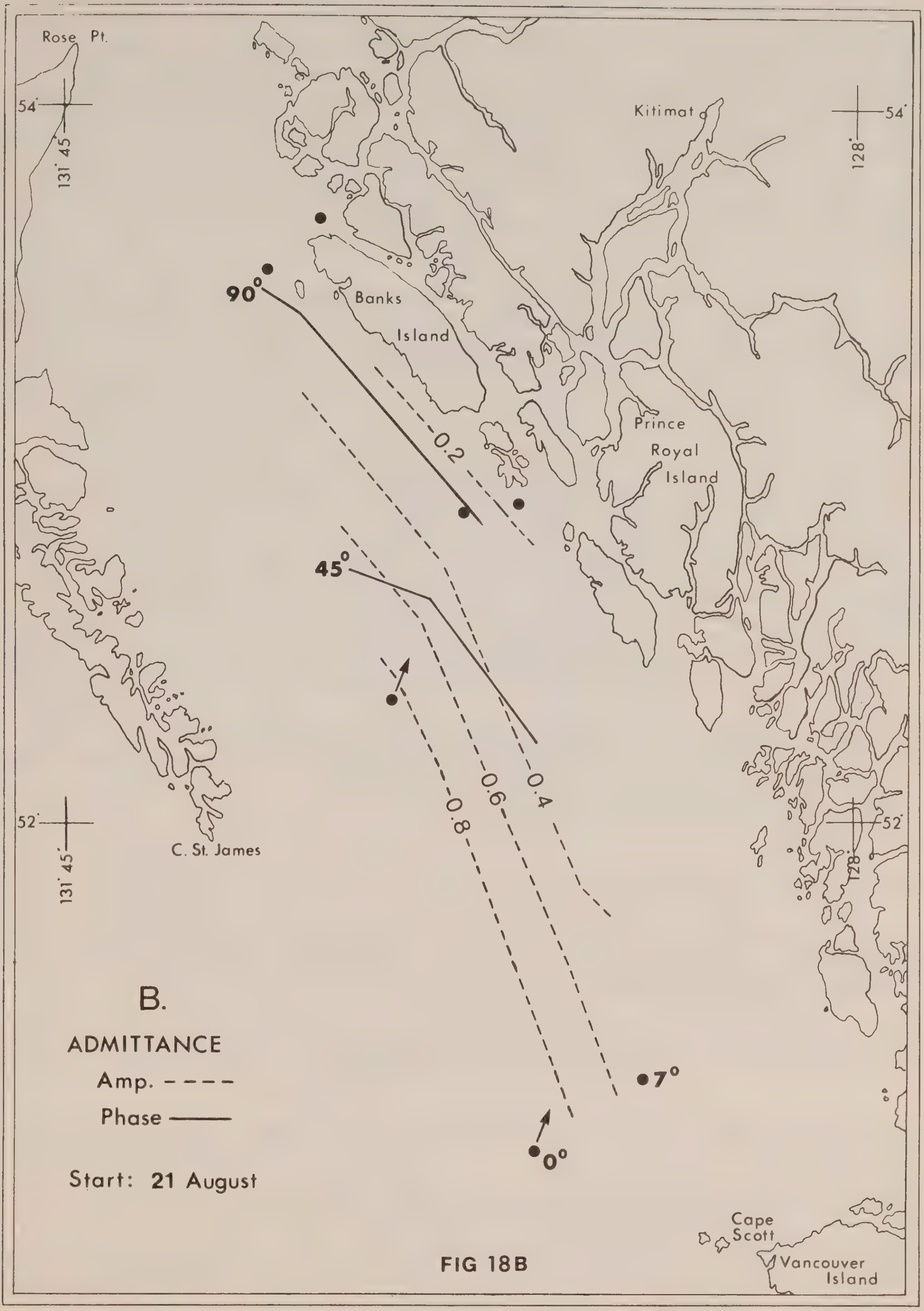

Rose Pt.
54°
131° 45'
Kitimat
54°
128°
180°
Banks
Island
90°
Prince
Royal
Island
43°
0.6
0.8
1.0
52°
131° 45'
C. St. James
52°
128°
1.2
0.4
A.
ADMITTANCE
Amp.
Phase
90°
0°
Start: 20 June
Cape
Scott
Vancouver
Island

FIG 18A



Rose Pt.
54°
131° 45'
Kitimat
54°
128°
Banks
Island
90°
0.2
Prince
Royal
Island
45°
0.4
0.6
0.8
52°
131° 45'
C. St. James
52°
128°
B.
ADMITTANCE
Amp. - - - -
Phase ———
Start: 21 August
7°
0°
Cape
Scott
Vancouver
Island

FIG 18B

from H01 to H02, 8.9 h ($c \simeq 2.7$ km h^{-1}). Results for the mid-August event are comparatively unreliable owing to missing or short current meter records (c.f. Table 1). Based on the triad Q07-Q03-Q04, the inertial signal again commenced first at the most southern mooring and advanced northeastward (20°T). However the estimates $c \simeq 110$ km h^{-1} and $\lambda \simeq 1.8 \times 10^3$ km greatly exceed other estimates and are presumably incorrect. The northern triad (H01-Q07-CS01), also indicates a northeastward (20°T) advance at Station Q07 but with $c = 29.3$ km h^{-1} ($\lambda = 490$ km), which are more consistent with the mid-June results. Use of the inertial oscillation at CS02 in place of CS01 yields propagation in the northwesterly direction ($c = 40.0$ km h^{-1}, $\lambda = 670$ km).

Comparison of the current phases derived by the admittance program (Fig. 18a) with the estimated arrival times of the storm front that initiated the mid-June event (Fig. 14) verifies that the inertial oscillations were transient responses to passage of traveling wind systems. The general northeastward phase lag of the wind - as interpolated from hourly shore based winds and the single anemometer mooring - corresponded reasonably well with a similar phase propagation of the inertial signal; the relatively long delay in rotation of the wind vector north of Vancouver Island could account for the short wavelength (85-95 km) determined for this region. Differences between the two time-lag diagrams could be due to the fact that current phases are based on 256-h record lengths whereas wind lags are associated only with the leading edge of the first storm of the mid-June sequence. Spatial differences in the orientation of the generating wind vector could also have produced non-temporal phase variations. In addition, winds at shore stations such as Cape Scott often differ from those offshore. A comparison of summer 1979 winds at Cape Scott and Sartine Island, a small offshore island 70 km to the west, indicates that the offshore winds are stronger and have greater variability (Falconer, 1981). Moreover winds from the southwest, south and east at Cape Scott are accompanied by south or southeast winds at Sartine Island. Conceivably, therefore, oceanic wind shifts that generated the inertial oscillations were not accurately reproduced by measured winds at Cape Scott.

7. ELLIPSE ORIENTATION

The phase velocity of linearized inertial-internal waves in a nondiffusive, stratified, rotating Boussinesq fluid with uniform horizontal mean flow $\underset{\sim}{U}$ makes an angle,

$$\phi = \pm \tan^{-1}\left[\left(\frac{N^2-\omega^{*2}}{\omega^{*2}-f^2}\right)^{\frac{1}{2}}\right]$$

with the horizontal; $\omega^* = \omega - \underset{\sim}{k}\cdot\underset{\sim}{U}$ is the intrinsic wave frequency, $\underset{\sim}{k}$ is the horizontal wavenumber and $f \leqslant \omega^* \leqslant N$. For purely inertial motions in zero mean flow, $\omega^* = f$ and $\phi = \pm 90°$. For $\omega^* \neq f$, however, the motions will have a horizontal component of phase propagation whose approximate orientation can be derived from the asymptotic WKB solutions for the horizontal velocity components (Kundu, 1976). This analysis, based on the assumption that vertical variations in N(z) occur over scales large compared to the vertical wavelength, shows that phase propagation is aligned with the major axis of

the current ellipse and the ratio of major to minor axis is ω^*/f.

The rotary spectral programs used here calculate ellipse orientation for a specified frequency band based on positively and negatively polarized velocity components. (Although velocity components are specified in a north-east coordinate system, the ellipses are invariant to coordinate rotation.) Ellipse orientations for near-surface bandpass filtered currents are assumed to have components coastward from the open ocean and are calculated using two different data segment durations. The first, for successive 64-h data segments with 32-h overlaps, provide estimates of phase direction variability with time; for brevity only results for the mid-June event are presented (Figs. 19a-c). The second, based on 256-h segments, yield mean ellipse orientations for the integrated effects of sequences of storms. Values have been derived for the two major events and are presented in Table 4. Also included are the ratios of clockwise to anticlockwise spectra, the rotary coefficients (which are a measure of the ellipticity) and the frequency ratios ω/f (determined from the high resolution spectra of Section 4).

Ellipse orientations in Figs. 19a-c vary as much as ±50° during the major event periods. In part this temporal variability is due to computational ambiguities when current oscillations are very nearly circularly polarized (rotary coefficient $\simeq -1$). Nonetheless, the values are consistent with eastward components of phase propagation over the sea. The most abrupt change in orientation occurred at Station Q04 where the inertial oscillations generated by the first major storm were directed to the southeast followed 4 days later by a reorientation to the northeast; the most constant orientation was at CS01 where phases were directed toward ∿30° (60°T) at right angles to the adjacent coastline.

The time-averaged ellipse orientations for the mid-June event period (Table 4) indicate a general phase propagation toward the northeast quadrant (0-90°T) except at Stations H01 and H02 where propagation was to the southeast. During the mid-August event, phases were northeast to north over the central region of the sea and east to southeast in the southern region. Because the rotary coefficient, R, is the difference between the normalized clockwise and counterclockwise spectra, the number $R^{-\frac{1}{2}}$ should approximate the ratio of major to minor axis of a given ellipse. However, even if we allow for the limited frequency resolution (± 0.001 cph) of the peak frequency in Figs. 8a,b the correspondence between the last two columns in Table 4 is not good. Because the peak spectral frequencies are based on 1024-h data records (to obtain the needed resolution) they may not be compatible with the shorter 256-h records used to calculate R. Alternatively, the differences between ω/f and the ellipse axis ratio may be due to the non-applicability of WKB solutions to the near-surface layer.

8. DOPPLER SHIFTED FREQUENCY

As noted in Section 5, short duration oscillations of less than inertial frequency were sometimes present in near-surface records. However, at no location were such motions as prevalent as at Station Q04 where, in the case of the mid-June event for example, they persisted longer than a week.

Figure 19. Orientations of inertial current ellipses versus time. Values denote angle of major axis counterclockwise from east (mathematical convention) for frequency of 0.06 cph and bandwidth of 0.02 cph. Each estimate spans 64 h of data and there are 32-h overlaps of data segments. Time represents start of given 64 h segment.

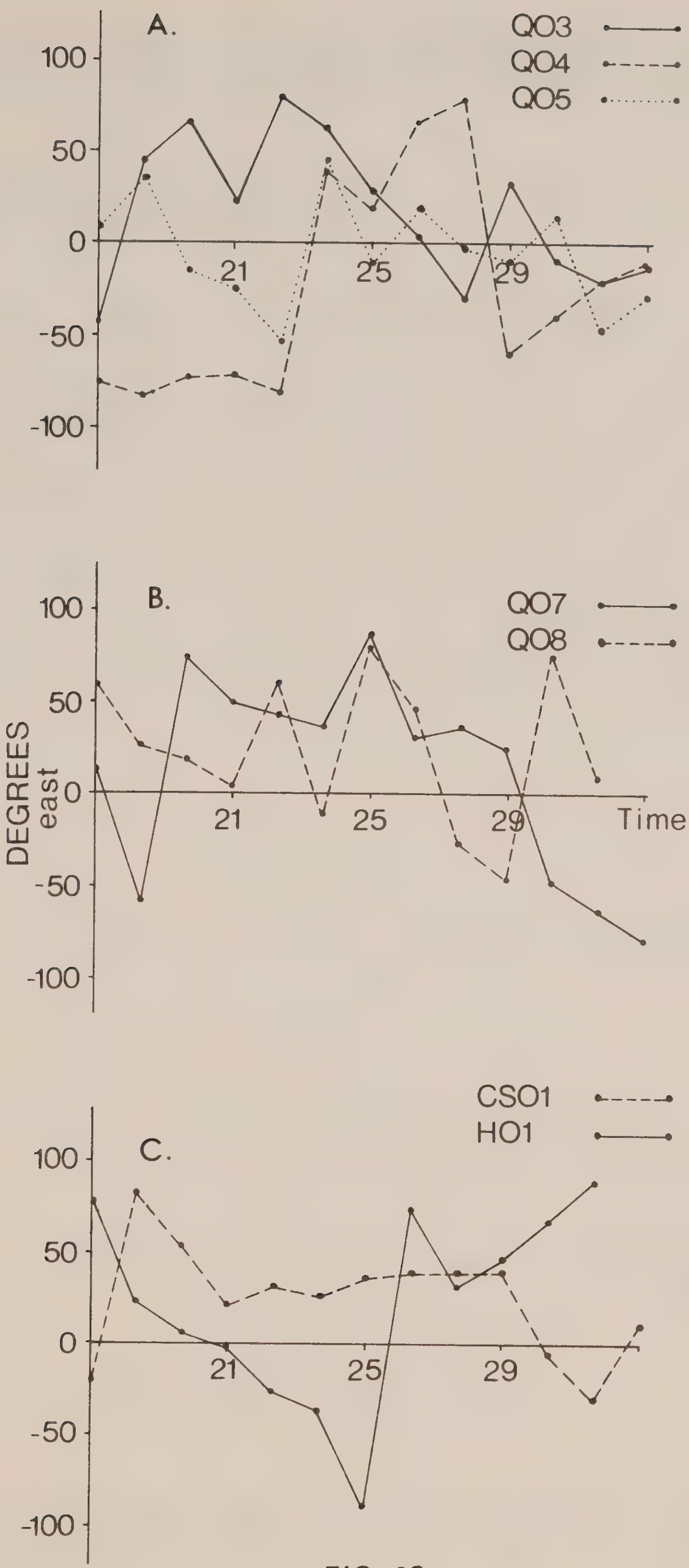

A.
QO3
QO4
QO5
100
50
0
-50
-100
21
25
29
B.
QO7
QO8
DEGREES
east
Time
C.
CSO1
HO1

FIG. 19

TABLE 4. Properties of inertial current ellipses based on 256 h filtered record lengths. Center frequency = 0.06 cph, bandwdth = 0.02 cph. Top value is for mid-June event beginning 20 June; bottom value for mid-August event beginning 19 August. Orientation of major ellipse axis clockwise relative to east; S_- = clockwise spectra, S_+ = counterclockwise spectra; R = -1 for clockwise circular rotation, $\overline{R}$ = 0 for rectilinear motion. Last column gives peak frequency, ω, from high resolution spectra of S_- divided by the local Coriolis frequency, f (see Table 5).

STATION	ORIENTATION ° from east	RATIO S_-/S_+	ROTARY COEFFICIENT, R	$\lvert R\rvert^{-\frac{1}{2}}$	ω/f ±0.015
Q03	39	238	-0.992	1.0040	1.019
		52	-0.962	1.020	1.050
Q04	87	11	-0.834	1.095	0.950
	-2	35	-0.944	1.029	0.950
Q05	-5	23	-0.916	1.045	1.014
	-	-	-	-	-
Q07	52	99	-0.980	1.010	0.998
	87	60	-0.967	1.017	1.058
Q08	22	52	-0.962	1.020	0.998
	-	-	-	-	-
CS01	34	70	-0.972	1.014	0.991
	79	44	-0.955	1.023	0.961
CS02	-	-	-	-	-
	16	8	-0.766	1.143	1.051
H01	-18	6	-0.701	1.194	1.013
	27	3	-0.460	1.474	0.931
H02	-30	2	-0.310	1.796	0.985

From the previous section we find that,

$$\frac{N^2-\omega^{*2}}{\omega^{*2}-f^2} = \tan^2\phi = \frac{n^2}{k^2} \tag{1}$$

where n and k are vertical and horizontal wavenumbers, respectively. Solving (1) for the intrinsic frequency, $\omega^* = \omega - \underset{\sim}{k}\cdot\underset{\sim}{U}$, and assuming a priori that $N >> \omega^*$ yields (see also White, 1972),

$$\omega = f[1 + (Nk/fn)^2]^{\frac{1}{2}} + \underset{\sim}{k}\cdot\underset{\sim}{U} \ . \tag{2}$$

Based on CTD observations in May and July, $N \sim 10^{-2} - 10^{-3}\ s^{-1}$ within the upper 25 m of Queen Charlotte Sound while from Pollard (1970) and Kundu (1976), $2\pi/n \simeq 10\text{-}100$ m. From Section 6 we find that the inertial oscillations at Q04 during the mid-June event had a wavenumber directed toward 95°T with magnitude $k = 2\pi/\lambda \sim 6.61 \times 10^{-5}\ m^{-1}$; directionality in this case is corroborated by the ellipse orientations described in Fig. 19a. Substituting these estimates into (2) together with the local value of the Coriolis parameter,

$$f = 1.1387 \times 10^{-4}\ s^{-1}$$

$$= 0.06524 \text{ cph},$$

we find

$$Nk/fn << 1.$$

As a consequence, (2) may be rewritten,

$$\omega = f + kU\cos\gamma \ , \tag{3}$$

where γ is the angle between the horizontal wavenumber and the mean velocity.

During the four days following onset of the mid-June event, the mean (lowpass filtered) velocity at Q04 was toward 326 ± 16°T at about 23.3 ± 2.3 cm s^{-1} (Fig. 20), whereby (3) becomes, for our single estimate for $\underset{\sim}{k}$,

$$\omega = (1.0418 \pm 0.420) \times 10^{-4}\ s^{-1}$$

$$= 0.0597 \pm 0.0024 \text{ cph}.$$

The latter is in close agreement with the value

$$\omega = 0.0566 \pm 0.0025 \text{ cph}$$

determined from the demodulation analysis (e.g. Fig. 17a) for those times during this event when the speed exceeded 5 cm s^{-1}.

Figure 20. Observed and low-pass filtered (mean) current components at Station Q04 before and during the June and August inertial events. Godin's (1972) tidal filter $A_{24} \cdot A_{24} \cdot A_{25}$ with half-power point 0.015 cph has been applied; coordinate axes are positive toward 10° and 280° True. Ticks above horizontal axes denote times of mean flow calculations for section 8.

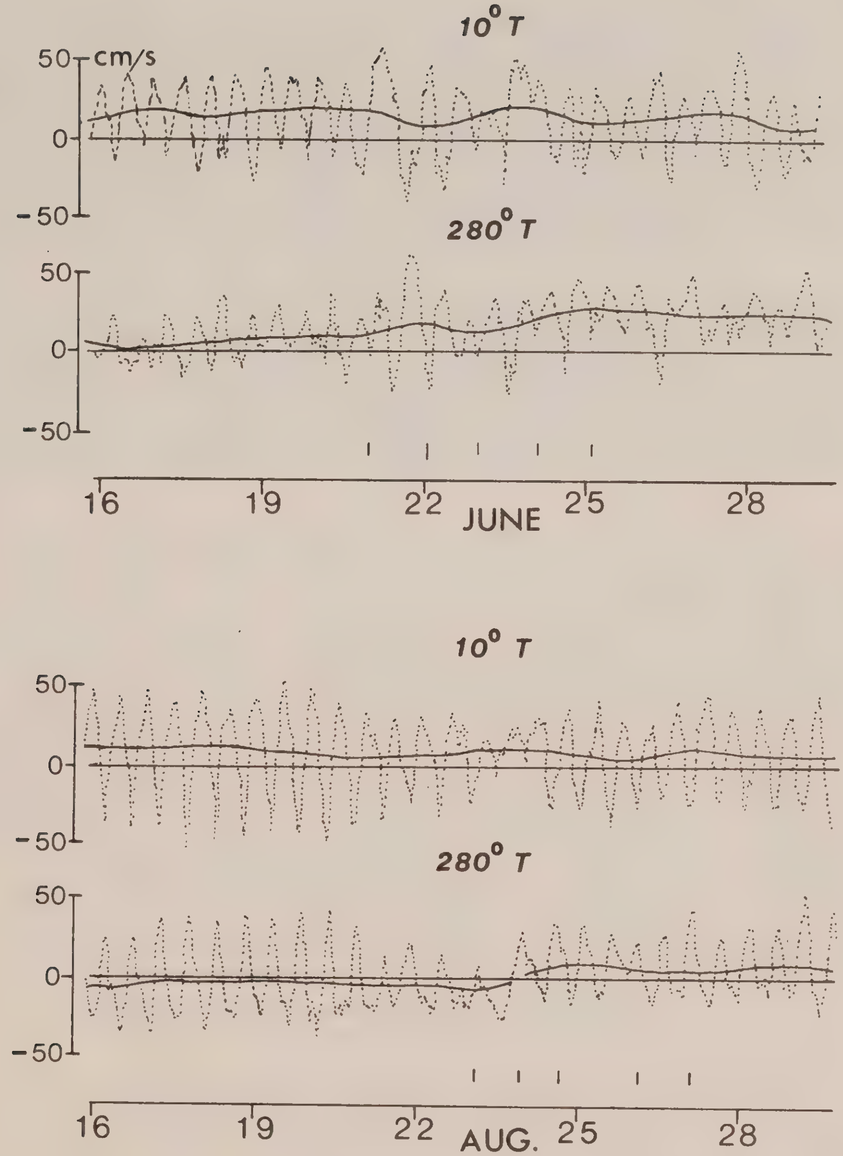

10° T
50
cm/s
0
-50
280° T
50
0
-50
16
19
22
JUNE
25
28
10° T
50
0
-50
280° T
50
0
-50
16
19
22
AUG.
25
28

FIG 20

For the four days following the mid-August event, the mean velocity at Q04 was toward 352 ± 43° at roughly 11.1 ± 1.3 cm s^{-1} which, for the previous value of $\underset{\sim}{k}$, yields

$$\omega = (1.1222 \pm 0.0500) \times 10^{-4}\ s^{-1}$$

$$= 0.0643 \pm 0.0029 \text{ cph.}$$

This approximates the peak spectral frequency in Fig. 8b and closely resembles the value,

$$\omega = 0.0638 \pm 0.0015 \text{ cph,}$$

derived from the demodulation analysis for the times of significant inertial amplitude. We therefore conclude that the anomalously low inertial frequencies at Q04 during the major event periods were due to a Doppler frequency shift of relatively high wavenumber, eastward propagating inertial waves by a persistent mean flow to the northwest. The persistent northward mean surface flow which characterized this region throughout the survey appears to represent a continuation of the seaward estuarine current that emanates from Queen Charlotte Strait in summer (Huggett et al, 1980).

The absence of persistent inertial oscillations of subinertial frequency at other moorings was probably due to longer wavelengths, weaker mean flows prior to the arrival of the wind events and/or propagation of means currents normal to the inertial waves. Moreover in certain locations (e.g. Q03), mean currents had a component in the direction of inertial wave propagation and would therefore give rise to a frequency slightly greater than f.

9. DISCUSSION AND SUMMARY

Intermittent near-surface currents of inertial frequency were common occurrences throughout the semi-enclosed sea off northwest British Columbia during the summer of 1977. Inertial oscillations also occurred within the seaward entrances of two large mainland channels and within 4-5 m of the bottom at depths of 155-330 m. The close correspondence between the onset of surface inertial currents and the passage of extratropical cyclones through or to the north of the region, confirms that winds, especially frontal winds, were the primary generation mechanism. Major inertial events, for example, were initiated by the arrival of 10-20 m s^{-1} southeast winds that veered to the south or southwest and weakened following passage of the front (e.g. Figs. 5a,b). The largest amplitude and most widespread event of the observational period, the mid-June event, was generated by strong winds whose local veering rate of $\sim 25°h^{-1}$ during the first 12 h coincided with the veering rate of the inertial oscillations (period ∿15.4 h). These wind-generated events were not strictly "inertial" but, according to the phases of the complex demodulation (Section 5), varied as much as ±20% of the local inertial frequency (f ∿0.065 cph). At times of large amplitude oscillations, however, frequencies usually deviated less than half this amount.

Near-surface inertial oscillations within the exposed portions of the sea were clockwise-rotary and circular, consistent with a downward propagation of locally wind-generated inertial energy. Corresponding oscillations within Caamaño Sound and the seaward approach to Browning Entrance (Fig. 1) were also clockwise-rotary and coincident with major events at exposed locations. However, the motions were elliptical rather than circular (ellipticity > 1.50 versus < 1.10) which, together with the fact that major axes were parallel to the channel orientation, suggests that the side boundaries were a constraint on the rotating motions [radius of curvature $r = (u^2 + v^2)^{\frac{1}{2}}/f \simeq 1$ km] or that there had been leakage from adjacent frequency bands. Clockwise rotary, inertial frequency oscillations were also observed near the bottom at the more western moorings (Q03, Q05, Q07) but, as indicated in Figs. 4b,d, were highly elliptical (ellipticity > 1.15), less than 10% of the near-surface speeds, and not readily linked with wind events. This absence of significant or coherent inertial motions at the seafloor was presumably the result of frictional dissipation and dispersion due to spatial inhomogeneities in mean currents and density. According to Pollard (1980), for example, surface-generated inertial oscillations have downward group velocities of only 0.03 - 3 m day^{-1} and therefore undergo marked vertical attenuation by dispersion and turbulent dissipation. Kundu's (1976) estimate of ∿25 m day^{-1} for the vertical component of the group velocity would also have allowed for appreciable attenuation over the present depths. Moreover, any damped oscillations that did penetrate to the bottom were probably further subjected to boundary layer dissipation. Because of the low speeds of these deeper currents, we have concentrated mainly on observations from the near-surface current meters (depths < 25 m).

Except for Station Q04, peak high resolution spectra (bandwidth = 0.002 cph) for near-surface regions of significant inertial current activity were centered at 0.066 cph. The latter were approximately 3½% greater than the local inertial frequency at the outer moorings (Q03 and Q05) and equal to f at remaining locations. Peak spectra at Q04, on the other hand, were centred at 0.062 cph or about 6½% below f for both deployment periods. As shown in Section 8, the consistently subinertial frequencies at this location were likely due to a Doppler shift of comparatively short wavelength (∿95 km) inertial oscillations propagating eastward in the presence of a northwest flowing mean current. The short wavelengths at Q04 appear to have resulted from a reduced transit speed for wind systems in southern Queen Charlotte Sound. Subinertial oscillations also occurred at other locations (e.g. Figs. 15 and 17) but, because of longer wavelengths and the nature of the local mean flows, did not persist as they did at Q04; Kundu (1976) also reported existence of short duration subinertial oscillations in records collected off the Oregon Coast but did not elaborate.

Near-surface inertial currents generated by a given storm usually persisted for 2-4 days (3-6 inertial periods) and had a typical duration of about 2½ days. Inertial events that exceeded four days duration consisted of sequential wave groups generated by eastward traveling cyclones with peak winds spaced a few inertial cycles apart. The mid-June event, in which strong near-surface oscillations lasted more than 8 days at most exposed locations and 11 days at Q05, resulted from a sequence of four storms spaced at roughly 2.5 day intervals that followed similar tracks toward the coast (Fig. 21). In this case, quasi-resonant forcing occurred where the southeast winds

Figure 21. Six-hourly positions of low pressure centres and fronts associated with the four eastward traveling extratropical cyclones that generated the mid-June event in Queen Charlotte Sound - Hecate Strait. Start time for each sequence is in upper right corner; star denotes beginning of storm track sequence, and x's subsequent storm centres each 6 hours. (From Atmospheric Environment Service, Canada, surface analysis charts.)

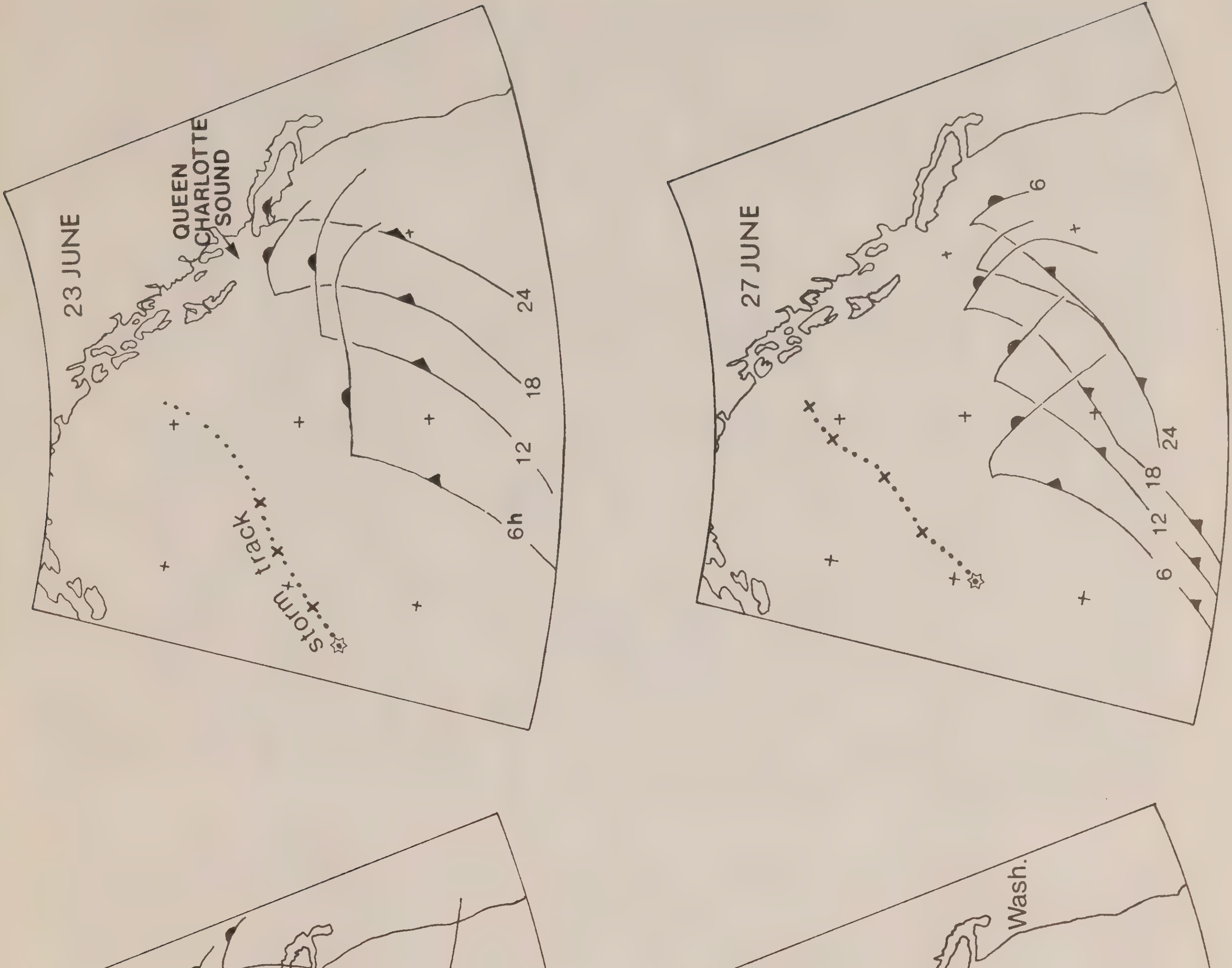

23 JUNE
QUEEN CHARLOTTE SOUND
storm track
6h
12
18
24
27 JUNE
6
12
18
24
20 JUNE
140
150°
50°
45
18h
24
6
12
18
24
25 JUNE
B.C.
Wash.
Gulf of Alaska
6
12
18
24

FIG. 21

leading each new storm were in-phase with the inertial current produced by the previous storm, with the exception in some locations of out-of-phase inertial currents generated by the fourth storm. The principal exception was at Station Q04 where inertial frequencies throughout the mid-June event were over 10% below f. Because of the alteration in frequency, the inertial current originating with the first storm was out-of-phase with the southeast winds of the second storm, and the oscillations subsequently damped. Similar results apply to the mid-August event.

Near-surface inertial currents for the mid-June and mid-August events were horizontally coherent to better than 95% confidence within the main portion of the sea, a longitudinal distance of more than 300 km (Table 3a). Such widely coherent inertial signals have not been previously reported and may have resulted from factors unique to the region. First, the structures of the wind fields generating the current did not change appreciably during advance over the sea and second the times between storms were such as to produce persistent motions with little disruption in phase or amplitude (except at Station Q04). This was also partly facilitated by passage of frontal regimes to the south of the mooring array (Fig. 21) thereby eliminating generation of secondary wave groups by the trailing arm of the frontal systems (e.g. Pollard, 1980). Moreover, inertial oscillations appeared to have been only marginally distorted by mean currents and inhomogeneities in water density. The exceptions were at CS01, where the first storm of the mid-August event generated a relatively weak inertial current, and at Q04 where mean currents produced a Doppler frequency shift. Coherences between currents in exposed locations and Caamaño Sound and Browning Entrance were below the 90% confidence limit and suggest that seaward flowing estuarine-type currents, density variations and boundary effects appreciably modified inertial oscillations within the channels.

The amplitudes of near-surface inertial currents generally decreased eastward and northward within the sea. For example, based on the high resolution spectra for the May-July deployment period, peak amplitudes varied from 11.0 cm s^{-1} at Station Q05 to 3.5 cm s^{-1} at Q08 and 2.4 cm s^{-1} at H01 (Table 5); corresponding values for the July-September deployment varied from 4.0 cm s^{-1} at Q03 to 1.8 cm s^{-1} at H01. Analyses of the major event periods yielded similar results (e.g. Figs. 10a,b). According to the bandpass filtered data (Figs. 5a,b; 17a-c), the maximum inertial amplitude is estimated to be ∿50 cm s^{-1} and occurred at the outer mooring Q05 during the first few cycles of the mid-June event. However, when only the tidal harmonics are removed from this record (Fig. 6) the peak speed estimate is closer to 75 cm s^{-1}, although neither method can be expected to isolate the inertial current completely.

The delays in the start time of the near-surface inertial oscillations for the mid-June event approximately coincided with the estimated time for the leading winds of the first storm to traverse the sea (cf Figs. 14 and 18a). Over the main sectors of the sea, currents had horizontal phase speeds of 20-40 km h^{-1} directed to the northeast whereas in the southeast sector of the mooring array phase speeds were around 5-6 km h^{-1} and directed to the east. The respective wavelengths of 300-700 km and 85-95 km agree reasonably well with the relationship $\lambda = S \cdot T$, where S is the speed of the advancing wind field and T the inertial period, confirming that inertial currents were local transient responses to the winds.

TABLE 5. Peak inertial frequencies and amplitudes (peak spectra x bandwidth)$^{\frac{1}{2}}$ for near-surface filtered currents based on high resolution spectra. Bandwidth = 0.002 cph, 4 degrees of freedom. First number in each column is for first deployment period (May-July, 1977); bracketed value is for second deployment period (July-September, 1977). Peak frequencies were less well-defined during second deployment period due to lower inertial energies. Station CS03 is omitted.

	STATION								
	Q03	Q04	Q05	Q07	Q08	CS01	CS02	H01	H02
Peak frequency CPH	0.066 (0.068)	0.062 (0.062)	0.066 -	0.066 (0.070)	0.066 (0.066)	0.066 (0.064)	- (0.070)	0.068 (0.062)	0.066 -
Peak amplitude cm s^{-1}	6.6 (4.0)	4.3 (2.4)	11.0 -	6.3 (4.0)	3.5 (1.2)	5.3 (1.6)	- (1.4)	2.4 (1.9)	0.5 -

The above results, combined with the observed attenuation of inertial signals toward the mainland coast, suggest that the topography of the land through modification of the winds strongly influenced the amplitudes of inertial oscillations. Not only were storm tracks altered near the coast but wind strengths diminished with dissipation of the landward moving frontal systems and winds near the eastern side were constrained to blow parallel to the coastline. The latter resulted in a west-to-east reduction in the degree of clockwise wind rotation and, in conjunction with diminished speeds, effectively reduced the wind's ability to generate inertial currents. Moreover, the apparent delay of the wind-forcing regime immediately north of Vancouver Island, which gave rise to the relatively small wavelengths at Q04, was presumably a topographic effect. Also in connection with wind-forcing, we note that the overall decrease from May to September in the amplitudes and frequencies of occurrence of inertial oscillations (Fig. 17) coincided with a reduction in the intensities and numbers of Pacific storms (Fig. 16). This suggests that it would be reasonable to expect considerably greater current amplitudes and durations in Queen Charlotte Sound and Hecate Strait during the winter as a result of enhanced storm activity in the northeast Pacific Ocean.

Finally, we have shown that the start times for major inertial events within the main region of the sea were accompanied by pronounced reductions in amplitude of the temperature and salinity fluctuations recorded by near-surface current meters. Qualitatively, this appears to reflect a deepening of the wind mixed layer from less than 7 m at Q05 to more than 24 m at Station Q04. In turn, the deepening probably was due to enhanced instability arising from vertical shears accompanying the vertically propagating inertial currents.

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INTRODUCTION

Past experiments in Controlled Experimental Ecosystems (CEEs) have looked at the impact of copper (Menzel, 1977) or of carbohydrate (Parsons et al, 1980-1) individually on marine organisms. These perturbations invariably stress some component of the food chain, causing either species shifts or suppression of a trophic level. A more realistic contaminant influx may be simulated by adding a mixture of organics, metals and/or pesticides - a condition more representative of input from sewage outfalls.

An experiment was designed in which a metal and an organic would jointly impact an ecosystem. Copper ($8\ \mu g \cdot L^{-1}$) and glucose ($4\ mg \cdot L^{-1}$) were added to a CEE, while a control and a copper treated enclosure were employed to help resolve the effects of the contaminants. The three CEEs were sampled daily for 12 days, with particular emphasis being given to the uptake of organic substrates by microorganisms. Sampling was frequent enough to give good detail of the population dynamics of bacteria under the pollutant stresses.

The impact of the glucose and copper additions was clearly demonstrated in the phytoplankton-copepod-carnivorous jelly food chain.

ACKNOWLEDGEMENT

The reliable work of K. Perry and B. Emerson both in the field and in the lab enabled us to maintain a hectic twice daily sampling routine which allowed the detail that this study has provided.

METHODS

Three ¼ scale CEEs, having a volume of 68 m^3 (Menzel and Case, 1977), were launched on July 5, 1981. The percentages of water captured by the launch were: control (bag B) - 82%, Cu treated (bag C) - 97%, and Cu+DOC (bag D) - 90%. The bags were filled to capacity by pumping water from 18 m onto the surface of the three enclosures, simultaneously. Sampling began the day after the CEEs were filled, with 9AM and 3PM samples being taken daily for heterotrophic parameters. Most other observations were made daily, each morning. The contaminants were added after the first samples were taken on Day 1 (July 6, 1981).

Pump samples were taken with a peristaltic pump from 0-5 m, 5-10 m and 10-13 m intervals for chlorophyll *a*, *b* & *c*, $^{14}CO_2$ uptake, phytoplankton, carbohydrate, copper, particulate organic carbon and nitrogen, and nutrients. Niskin bottle samples were taken at 1 and 12 m for bacterial analyses and at 1, 2.5, 7.5 and 12 m for O_2. Sediments were removed from the bottom of each CEE and subsampled for POC/N. Salinity and temperature were measured with an Applied Microsystems CTD. Zooplankton tows were made three times each week from 13 to 0 m with a 30 cm diameter, 202 μm mesh net.

Chlorophylls were measured by the procedure of Humphrey (1975). CO_2 uptake was measured by inoculating 125 mL bottles (2 light and 1 dark) with 2.5 μCi $NaH^{14}CO_3$ and incubating *in situ* for 4 h, using a time zero inoculation as a blank. Samples were filtered onto Millipore HA filters and counted in Aquasol (NEN) using a Beckman LS 3133 liquid scintillation counter (Strickland and Parsons, 1972).

Phytoplankton samples were mixed from the three intervals and counted as a 0-13 m sample. The samples were Lugols preserved and counted on an inverted microscope. In Table 7, "other" diatoms refer to rare species, including *Leptocylindrus danicus* and *Rhizosolenia* sp.

Zooplankton were formalin preserved and identified usually to genus.

POC/N samples were filtered onto pre-combusted glass fiber filters (Whatman GF/C), dried and combusted at 750°C in a Perkin-Elmer model 240 CHN analyzer.

Oxygen titrations were performed by the micro-Winkler procedure (Strickland and Parsons, 1972).

Nutrients were analyzed on a Technicon auto-analyzer, using modified Technicon procedures. Samples were not frozen immediately, but always within 3 h.

Procedures for microbial uptake rates, bacterial counts and ATP measurements are referenced in Seki et al (1975). Michaelis-Menten kinetics can be used to describe the uptake of organics by microorganisms as follows:

$$V_t = \frac{S_n x V}{K_t + S_n}$$

where V_t is the <u>in situ</u> uptake rate, V is the maximum rate of uptake, S_n is the concentration of the substrate and K_t is the substrate concentration at ½V. Turnover times (T_t) of the natural substrate concentration (S_n) is determined by adding small amounts of ^{14}C labelled substrates and measuring the fraction (f) that is remineralized in the incubation period t, such that $T_t = \frac{t}{f}$. The use of turnover time alone as an indicator of bacterial activity is subject to the errors of changing bacterial biomass and S_n. However, the bacterial population changes only accentuate the trends observed in turnover times and is therefore a suitable parameter for comparing bacterial activity under the various conditions created in this study.

Total and dissolved copper were measured by the procedure of Danielsson et al (1978). Dissolved copper was analyzed as that which passed through a 0.4 μm filter.

Carbohydrate analyses were done by the method outlined in Strickland and Parsons (1972).

RESULTS

Sampling began the day after the CEEs were filled. Initially, the three enclosures were quite similar, having nitrate-nitrite levels of 5.5 ± 0.4 μM and chlorophyll a concentrations of 4.0 ± 0.6 mg L^{-1} from 0-13 m. Calanoid copepods numbered 10,400 ± 560 m^{-3} on Day 1. Following the initial sampling, additions of ca 8 μg Cu L^{-1} to the Cu bag and 8 μg Cu L^{-1} and 4 mg glucose L^{-1} to the Cu+DOC bag were made from 0-13 m. Sampling on Day 3 shows distinct decreases in primary production (Fig. 3), ciliates (Fig. 4), calanoid copepods (Fig. 5) and carnivorous jellies (Fig. 6) in both Cu treated containers, compared with the control.

The three bags continued to diverge with time. The control bag maintained a low phytoplankton biomass (Fig. 4) whilst producing substantial copepod and ciliate populations. Nutrient levels decreased gradually (Fig. 1). It appears that the grazing zooplankton effectively controlled the algae and also stimulated carnivore growth. Larvaceans, which have been shown to be bacteria grazers (King et al, 1980), bloomed in the control bag (Fig. 6).

The copper treated bag produced a centric diatom bloom (Table 7) which depleted the nitrate-nitrite supply by Day 9. Noctiluca sp. growth coincided with the diatom pulse in both Cu treated bags (Fig. 6). Photosynthetic nanoflagellates produced a bloom of 22,000 cells mL^{-1} in the Cu bag and 61,000 cells mL^{-1} in the Cu+DOC bag following the diatom growth.

The Cu+DOC container responded to the addition of glucose by producing a bacterial bloom which reached 48 x 10^6 cells mL^{-1} at 12 m by Day 4. Nitrate-nitrite was rapidly utilized, as was the added glucose (Table 12). Bacteria numbers decreased to 10 x 10^6 cells mL^{-1} the day after the carbohydrate level had reached background concentrations. The turnover times (T_t) of glutamic acid, glycollic acid and galactose increased for the 2 days following the copper spike, with the glucose addition accentuating this effect. For example, glutamic acid consistently had turnover times of between 100 and 400 h in the control. In the Cu+DOC stressed communities, glutamic acid turnover times fluctuated from over 1000 h shortly after the addition of Cu, to less than 20 h when the bacterial population had recovered.

Sedimented materials were removed daily from the bottom of each bag. Throughout the 12 day study, the control bag produced less sediment with higher C:N ratios than the Cu treated enclosures (Fig. 7). By Day 12, 19.7 and 18.5 g carbon had settled out of the Cu and the Cu+DOC bags, whereas the control produced only 8.1 g C (area of a CEE = 4.9 m^2).

DISCUSSION

The copper and copper plus glucose addtions established distinctly different populations in the enclosures. The control bag had a healthy population of copepods and ciliates which were able to limit algal growth. Throughout the study, nutrients were never limiting. Primary production per unit chlorophyll was continually higher in the control than in either Cu treated container. In response to the high secondary production of copepods (exceeding 11,000 m^{-3}), a steady increase in carnivorous zooplankton was observed.

The Cu additions had a fatal impact on the grazing zooplankton. In the Cu bag, this allowed centric diatoms to bloom, resulting in nitrate-nitrite depletion.

The addition of glucose in the third container stimulated bacterial growth, causing rapid nutrient depletion and a bacterial bloom on Day 4. Bacterial biomass accounted for 0.9 mg $C \cdot L^{-1}$ (factors of Watson et al, 1977), which equals 60% of the carbon added as glucose. The removal of inorganic nitrogen sources must have limited diatom growth. Subsequently, a nanoflagellate bloom reached 61,000 $cells \cdot mL^{-1}$, an order of magnitude higher than any commonly found in Saanich Inlet (Takahashi et al, 1977; Whitney and Takahashi, in prep.).

It is not obvious why nanoflagellates bloomed so strongly, but reduced grazing pressure must have permitted the high growth rates of 1.6 $doublings \cdot d^{-1}$ between Days 3 and 5 (growth rate, u, from Parsons et al, 1977). Lysis of bacterial cells could have provided nutrients for this bloom. The rapid growth rate of the bacterial population in the Cu+DOC bag (3.2 $doublings \cdot d^{-1}$) permitted the bacteria to out-compete phytoplankton for the nutrient supply.

In an experiment which studied the effects of pentachlorophenol on marine organisms (Whitney et al, 1980), changes in algal species and in primary production rates were the more obvious results of the pollutant stress. In that study, a 30% reduction in settled material was the result of the pollutant impact. The copper stress, however, produced a distinctly different effect in the ecosystem, with major changes being observed in secondary and tertiary production. The net effect was one of increased sedimentation caused by a lack of grazing.

Quantifying the effect of a pollutant is obviously not a simple matter. To make the judgement that one species is more desirable than another is too subjective. Physiological indicators of the health of an organism have value, but are difficult to translate into a concept of overall impact. The comparison between clean and polluted ecosystems must provide the desirable approach to assessment of pollutant impact. This approach suffers from being descriptive. Perhaps a comparison between the success of various trophic levels in treated and untreated systems is as bold a quantification as can be made. This type of comparison would lead to the suggestion that, at least in the simple ecosystem enclosed by a CEE, the effects of copper are more devastating at moderate levels than are the effects of pentachlorophenol at high levels. This is realized in the success of the herbivorous and carnivorous zooplankton under the stress of PCP, whereas these organisms failed to survive the impact of copper.

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TABLES

TABLE 1a

NITRATE & NITRITE (μM)

	DAY											
SAMPLE	1	2	3	4	5	6	7	8	9	10	11	12
B 0-5	3.8	3.0	2.4	1.3	1.3	0.5	0.0	0.3	0.2	0.0	0.1	0.0
5-10	6.9	4.7	3.9	3.2	2.6	1.8	1.7	1.2	1.1	1.1	0.8	0.7
10-13	7.7	7.0	6.8	6.2	5.7	5.5	4.9	4.9	3.5	3.3	2.7	2.2
C 0-5	2.5	1.3	0.4	0.2	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0
5-10	5.9	4.9	2.9	2.0	0.6	0.2	1.7	0.0	0.0	0.0	0.0	0.0
10-13	7.9	7.6	7.0	6.8	5.2	4.1	1.7	0.6	0.1	0.0	0.0	0.0
D 0-5	2.4	1.9	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-10	7.0	4.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
10-13	9.2	7.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE 1b

PHOSPHATE (μM)

SAMPLE	DAY 1	2	3	4	5	6	7	8	9	10	11	12
B 0-5	0.93	0.80	0.83	0.74	0.76	0.70	0.47	0.69	0.71	0.68	0.56	0.65
5-10	1.13	1.03	0.95	0.95	0.89	0.84	1.16	0.82	0.79	0.78	1.24	0.92
10-13	1.52	1.28	1.33	1.29	1.18	1.23	0.83	1.21	1.06	1.06	1.12	0.38
C 0-5	0.81	0.73	0.71	0.55	0.52	0.54	0.76	0.40	0.37	0.45	0.36	0.43
5-10	1.37	1.09	0.87	0.81	0.69	0.56	0.54	0.91	0.47	0.48	0.43	0.35
10-13	1.45	1.36	1.29	1.31	1.15	1.16	0.95	0.80	0.77	0.68	0.66	0.31
D 0-5	0.77	0.86	0.53	0.48	0.41	0.54	0.39	0.33	0.27	0.27	0.25	0.26
5-10	1.17	1.05	0.40	0.37	0.35	0.38	0.37	0.41	0.31	0.32	0.29	0.50
10-13	1.43	1.37	0.53	0.45	0.52	0.71	0.78	0.78	0.65	0.60	0.61	0.56

TABLE 1c

SILICATE (μM)

SAMPLE	DAY											
	1	2	3	4	5	6	7	8	9	10	11	12
B 0-5	16.9	16.5	15.8	15.1	15.1	15.3	13.2	18.0	16.3	16.1	14.0	16.0
5-10	24.0	18.1	16.9	16.7	16.0	15.7	18.3	15.7	17.7	18.4	17.2	14.1
10-13	22.4	21.5	20.6	20.1	19.4	19.4	19.2	22.6	19.5	19.5	17.4	17.9
C 0-5	17.3	15.8	14.6	13.7	15.1	13.7	15.5	14.7	15.2	13.5	14.4	17.1
5-10	20.1	19.4	18.3	16.0	13.9	17.6	15.9	12.9	14.7	15.1	13.7	15.5
10-13	23.3	22.9	21.7	22.4	18.0	16.9	15.2	14.0	14.5	16.5	16.9	19.6
D 0-5	15.7	16.0	16.2	16.7	16.0	16.7	15.1	13.6	16.1	18.6	19.2	19.0
5-10	25.1	19.0	16.0	17.4	16.9	19.2	16.6	18.2	16.5	16.7	19.2	19.2
10-13	27.4	22.9	23.1	21.2	20.8	22.3	23.5	21.2	18.1	17.9	12.8	21.0

TABLE 2

OXYGEN (mL $O_2 \cdot L^{-1}$)

SAMPLE	DAY 1	2	3	4	5	6	7	8	9	10	11	12
B 1	7.008	6.957	6.936	7.282	7.112	7.547	7.908	7.682	7.654	7.983	7.650	7.487
2.5	7.020	6.971	6.994	7.263	7.489	7.562	7.974	7.728	7.634	7.948	7.791	7.648
7.5	6.756	6.711	6.818	6.648	6.900	6.933	7.020	6.900	6.894	7.136	7.134	7.212
12	6.231	6.237	6.237	6.240	6.189	6.093	6.046	6.073	6.144	6.205	6.174	6.221
C 1	7.202	7.308	7.495	7.821	7.643	7.792	8.194	8.075	8.133	8.858	8.812	8.370
2.5	7.239	7.314	7.517	7.820	7.740	7.817	8.312	8.259	8.264	8.963	8.797	8.518
7.5	6.649	6.644	7.261	7.294	7.791	7.962	7.997	7.925	7.685	7.901	8.161	8.133
12	6.124	6.270	6.321	6.403	6.457	6.605	6.740	6.896	6.786	6.836	6.858	6.928
D 1	7.136	7.136	7.027	7.113	6.740	6.747	6.964	7.355	7.642	8.156	8.129	7.853
2.5	7.132	7.143	7.067	7.090	6.818	6.734	7.024	7.519	7.676	8.197	8.197	7.967
7.5	6.594	6.744	6.805	6.447	6.403	6.164	6.138	6.249	6.123	6.579	7.091	6.884
12	6.168	6.273	5.634	5.196	4.751	4.549	4.334	4.323	4.343	4.340	4.389	4.607

TABLE 3

TEMPERATURE & SALINITY

		Bag B		Bag C		Bag D	
DAY	DEPTH (m)	t(°C)	s(°/oo)	t(°C)	s(°/oo)	t(°C)	s(°/oo)
*1	1		28.4		28.3		28.3
	12		28.8		28.3		28.8
*3	1		28.5		28.5		28.4
	12		28.8		28.7		28.8
4	0	15.8	28.6	16.2	28.1	15.9	28.2
	1	15.4	28.5	15.5	28.4	15.4	28.4
	2.5	14.9	28.5	15.0	28.5	15.2	28.4
	5	13.4	28.5	13.8	28.4	13.8	28.4
	7.5	12.8	28.4	12.9	28.5	13.0	28.2
	10	12.3	28.5	12.3	28.6	12.3	28.5
	12	11.9	28.6	12.0	28.3	12.0	28.5
5	0	15.0	28.4	15.1	28.4	15.2	28.4
	1	14.8	28.5	14.9	28.4	14.8	28.4
	2.5	14.7	28.5	14.8	28.4	14.7	28.3
	5	14.2	28.4	14.1	28.4	14.0	28.4
	7.5	13.0	28.5	13.0	28.5	13.0	28.3
	10	12.6	28.6	12.7	28.6	12.6	28.6
	12	12.4	28.6	12.5	28.6	12.4	28.5
6	0	15.0	28.4	15.1	28.4	15.2	28.3
	1	14.9	28.5	15.0	28.4	15.1	28.3
	2.5	14.8	28.5	14.9	28.4	15.0	28.3
	5	14.3	28.5	14.5	28.4	14.5	28.4
	7.5	13.5	28.4	13.4	28.4	13.4	28.3
	10	12.9	28.5	13.0	28.3	12.9	28.5
	12	12.7	28.6	12.8	28.6	12.7	28.5
7	0	15.5	28.6	15.7	28.3	15.7	28.5
	1	15.2	28.5	15.3	28.5	15.3	28.4
	2.5	14.9	28.5	15.0	28.5	15.1	28.3
	5	14.6	28.5	14.6	28.5	14.6	28.4
	7.5	13.9	28.6	14.0	28.4	13.9	28.3
	10	13.1	28.5	13.4	28.5	13.2	28.5
	12	12.9	28.5	12.9	28.6	12.9	28.6
8	0	15.4	28.3	15.5	28.3	15.6	28.2
	1	15.3	28.2	15.5	28.3	15.5	28.2
	2.5	15.2	28.2	15.3	28.3	15.3	28.2
	5	15.0	28.2	14.6	28.3	14.6	28.2
	7.5	13.8	28.4	13.8	28.4	13.8	28.3
	10	13.2	28.4	13.3	28.4	13.3	28.5
	12	13.0	28.3	13.0	28.5	13.1	28.4
9	0	15.9	28.3	15.8	28.4	15.8	28.3
	1	15.7	28.5	15.7	28.4	15.7	28.3
	2.5	15.6	28.5	15.6	28.4	15.6	28.3
	5	15.6	28.4	15.4	28.4	15.5	28.4
	7.5	14.8	28.7	14.9	28.5	15.0	28.5
	10	13.7	28.5	13.8	28.5	14.0	28.4
	12	13.2	28.6	13.3	28.6	13.4	28.5

DAY	DEPTH	Bag B t(°C)	Bag B s(°/oo)	Bag C t(°C)	Bag C s(°/oo)	Bag D t(°C)	Bag D s(°/oo)
11	0	16.9	28.5	18.9	28.5	18.9	28.6
	1	15.7	28.1	15.8	28.1	16.5	28.6
	2.5	14.3	28.4	14.5	28.3	15.3	28.3
	5	13.6	28.5	13.8	28.5	13.7	28.3
	7.5	13.2	28.4	13.3	28.4	13.2	28.4
	10	12.8	28.5	12.8	28.5	12.9	28.4
	12	12.5	28.4	12.4	28.5	12.6	28.4
12	0	15.5	28.5	15.0	28.6	15.4	28.4
	1	14.7	28.3	14.7	28.5	14.8	28.3
	2.5	13.9	28.4	14.3	28.4	14.4	28.2
	5	13.3	28.4	13.4	28.4	13.3	28.3
	7.5	12.9	28.3	13.0	28.4	13.0	28.3
	10	12.5	28.4	12.6	28.4	12.6	28.4
	12	12.3	28.5	12.4	28.4	12.3	28.5

* Salinities on Days 1 and 3 were analyzed on a Guildline Autosal.

TABLE 4

COPPER ($\mu g \cdot L^{-1}$)

	DAY 2		DAY 3		DAY 5		DAY 8		DAY 10		DAY 12	
SAMPLE	T	D	T	D	T	D	T	D	T	D	T	D
C 0-5	7.6	6.8	8.4	7.9	8.0	7.8	7.1	5.9	6.5	5.2	7.1	6.2
5-10	8.0	8.0	8.4	8.1	7.3	7.3	7.3	6.0	6.4	5.2	6.6	5.8
10-13	9.0	9.0	8.2	8.2	8.0	7.9	7.4	5.1	6.5	4.8	7.1	6.3
D 0-5	8.7	8.1	9.0	8.2	7.5	7.4	8.2	5.2	5.8	4.3	6.5	6.0
5-10	8.3	8.1	7.9	7.6	7.7	7.4	5.9	5.3	6.0	4.7	7.3	6.1
10-13	8.0	8.0	7.3	(7.5)	7.0	6.5	6.9	5.1	6.4	4.6	6.8	5.6

D = dissolved, after removing particulates > 0.4 μm
T = total

TABLE 5

CHLOROPHYLL a, b & c ($mg \cdot m^{-3}$)

DAY/ DEPTH	B			C			D		
	a	b	c	a	b	c	a	b	c
1/ 0-5	2.82	2.04	0.99	4.26	3.37	1.47	3.18	2.54	0.93
5-10	3.16	2.40	0.90	4.53	3.66	1.66	4.15	3.39	1.36
10-13	4.26	3.37	1.39	5.01	4.07	1.73	5.45	4.50	2.00
2/ 0-5	3.46	2.83	0.63	5.06	4.36	1.58	3.11	2.51	0.85
5-10	2.41	1.72	0.49	4.29	3.45	1.45	3.01	2.47	0.83
10-13	2.41	1.66	0.43	4.01	3.21	1.23	5.27	4.49	1.88
3/ 0-5	4.31	3.67	1.24	5.81	5.05	1.99	4.51	3.94	1.35
5-10	2.95	2.26	0.75	6.78	5.90	2.42	4.07	3.48	1.30
10-13	3.39	2.70	0.94	6.44	5.51	2.24	6.60	5.75	2.49
4/ 0-5	1.41	-	-	3.49	3.36	1.03	3.23	2.87	0.98
5-10	3.94	3.24	1.20	9.57	8.77	3.26	3.18	2.66	0.89
10-13	0.43	0.57	0.75	5.88	5.16	2.47	4.49	3.66	1.51
5/ 0-5	2.13	1.90	0.48	2.88	2.65	0.88	2.35	1.98	0.66
5-10	3.91	3.10	1.24	12.20	11.17	5.36	2.76	2.28	0.90
10-13	2.99	2.14	0.87	15.60	14.12	6.92	5.10	4.35	1.88
6/ 0-5	1.42	1.21	0.22	4.49	4.23	1.45	2.35	1.91	0.76
5-10	2.51	1.73	0.79	5.97	5.47	2.32	2.46	1.95	0.85
10-13	4.08	3.30	1.29	21.24	19.03	9.48	5.43	4.79	2.11
7/ 0-5	2.45	2.06	0.46	3.78	3.35	1.26	4.32	3.91	1.94
5-10	2.13	1.52	0.47	4.43	3.98	1.73	4.10	3.51	1.80
10-13	3.60	2.84	1.09	16.96	15.58	7.47	4.07	3.34	1.49
8/ 0-5	2.27	2.09	0.46	3.99	3.45	1.29	7.61	6.99	3.00
5-10	2.13	1.47	0.42	5.23	4.56	2.20	5.04	4.16	2.21
10-13	2.13	1.46	0.49	10.24	9.38	4.68	5.04	4.18	1.99
9/ 0-5	3.36	3.52	0.80	10.01	8.65	3.93	9.73	8.48	4.26
5-10	1.88	1.42	0.36	6.01	5.26	2.69	9.53	8.09	4.69
10-13	1.96	1.32	0.42	10.97	9.97	5.26	7.48	6.27	3.28
10/ 0-5	3.23	3.31	0.97	6.01	5.31	2.25	5.46	4.93	2.14
5-10	1.16	0.66	0.12	4.20	3.58	1.59	6.42	5.68	2.95
10-13	1.03	0.47	0.15	7.75	7.00	3.47	10.56	9.53	5.21

DAY/ DEPTH	B			C			D		
	a	b	c	a	b	c	a	b	c
11/									
0-5	2.39	2.34	0.48	2.36	1.86	0.63	3.89	3.38	1.50
5-10	1.60	1.17	0.29	2.90	2.35	0.92	3.75	3.24	1.57
10-13	0.85	0.39	0.12	5.54	4.83	2.27	12.65	11.33	6.50
12/									
0-5	2.96	3.09	0.68	1.33	0.91	0.30	2.08	1.54	0.66
5-10	2.12	1.63	0.57	1.85	1.33	0.45	2.39	1.79	0.88
10-13	1.10	0.57	0.13	3.79	3.22	1.38	9.84	8.77	5.05

TABLE 6a

PRIMARY PRODUCTIVITY
($mg\ C \cdot m^{-3} \cdot h^{-1}$)

LIGHT AND DARK UPTAKE CO_2

DAY / DEPTH	B LIGHT	B DARK	C LIGHT	C DARK	D LIGHT	D DARK
1/ 0-5	3.33	16.40	20.34	16.71	14.82	6.36
5-10	14.05	13.22	8.20	12.91	14.99	16.44
10-13	4.26	5.06	0.14	13.56	10.26	4.00
3/ 0-5	11.43	22.88	4.85	31.46	3.35	24.33
5-10	1.23	21.91	3.37	20.66	0.77	14.98
10-13	0.41	23.12	*	29.02	*	14.89
5/ 0-5	9.01	-	9.73	0.57	5.96	-
5-10	6.13	-	11.89	0.64	2.21	-
10-13	1.86	-	3.55	0.13	1.12	-
8/ 0-5	11.13	1.35	7.65	1.77	18.81	0.59
5-10	2.24	1.18	2.63	1.55	3.36	0.98
10-13	2.27	0.63	0.59	1.74	1.38	0.42
10/ 0-5	15.71	0.04	8.73	-	9.99	0.04
5-10	3.49	0.65	4.46	0.58	6.23	0.11
10-13	0.76	0.34	2.51	0.26	1.09	-
12/ 0-5	15.16	0.20	4.28	0.33	5.15	0.21
5-10	5.54	0.27	2.45	0.36	3.00	0.42
10-13	0.58	0.09	1.38	0.04	1.63	0.26

* dark uptake greater than light uptake
\- zero control greater than dark bottle

TABLE 6b

PRIMARY PRODUCTIVITY
mg C(mg chla)$^{-1}$.m^{-3}.h^{-1}

DAY/ DEPTH	B	C	D
1/ 0-5	1.18	4.80	4.66
5-10	4.45	1.81	3.61
10-13	1.00	1.01	1.88
3/ 0-5	2.65	0.83	0.74
5-10	2.40	0.50	0.19
10-13	0.12	*	*
5/ 0-5	4.23	3.38	2.54
5-10	1.57	0.97	0.80
10-13	0.62	0.23	0.22
8/ 0-5	4.90	1.92	2.47
5-10	1.05	0.50	0.67
10-13	1.07	0.06	0.27
10/ 0-5	4.86	1.45	1.83
5-10	3.01	1.05	0.97
10-13	0.74	0.32	0.10
12/ 0-5	5.10	3.22	2.48
5-10	2.61	1.32	1.26
10-13	0.53	0.36	0.17

*dark uptake greater than light uptake

TABLE 7 PHYTOPLANKTON (cells mL^{-1}) 0-13m

	DAY 1			DAY 3			DAY 5			DAY 8			DAY 10			DAY 12		
	B	C	D	B	C	D	B	C	D	B	C	D	B	C	D	B	C	D
Chaetoceros chains																		
4-15μm	23	40	18	163	196	173	-	78	104	-	19	28	-	12	7	-	5	-
16-25μm	-	10	2	9	43	31	9	74	14	-	19	12	-	5	5	-	9	7
26-35μm			2		19	7		37	5		7			2			2	
single cells	8	2	1	7	9		9	60	7			2	4	9				5
Thalassiosira spp.																		
5-20μm	22	7	1	-	5	9	-	-	9	-	9	-	-	7	-	-	-	2
21-40μm	14	57	25	24	137	118	14	279	73	-	64	35	-	24	2	-	14	7
41-60μm	-	2	-	-	14	-	9	15	-	-	17	2						
Skeletonema costatum																		
3-10μm	7	-	-	26	14	12	-	153	-	-	28	-	-	9	-			
11-20μm	11	19	3	14	-	-												
Biddulphia spp.	2	2	1	2	2	5	7	11	5	-	-	7	-	-	2	-	-	2
Coscinodiscus spp.																		
<50μm	5	4	1				-	7	-	-	7	-						
>50μm	-	7	4	-	-	7	2	-	5	2	-	-	-	-	2			
Ditylum brightwellii	-	2	-				-	4	-							-	-	2
others (rare)				-	12	14	-	-	7									
Total Centrics	94	173	59	246	452	277	66	733	230	2	170	88	4	69	19	0	31	26
Ciliates	7	12	17	45	19	19	116	19	14	258	24	38	86	59	43	21	66	40

TABLE 7 (cont.) PHYTOPLANKTON (cells mL^{-1}) 0-13m

	DAY 1			DAY 3			DAY 5			DAY 8			DAY 10			DAY 12		
	B	C	D	B	C	D	B	C	D	B	C	D	B	C	D	B	C	D
Asterionella	6	2	2	2														
Nitzschia spp.	22	14	11	71	49	62	55	135	80	64	220	92	126	116	43	523	102	38
Naviculoid penn.																		
5-20μm	2	2	1	5	5	0			17		17	7				2		
21-40μm	4	2	3	7	26	5	5	22	26	2	19	2		5	7	9	7	
41-60μm	2	5	4		9	5		4	5	2		14		24	24	2	28	
61-80μm			1								2						5	2
>80μm	2		1	2						2	5			2		19	17	
others		5		9	12	9	10			38	7						5	
Total Pennates	39	31	27	97	102	80	59	167	128	109	263	116	126	147	73	547	163	40
Dinoflagellates																		
5-15μm	121	120	12	19	44	22	32	37	48	72	12	27	112	12	28	161	33	81
16-50μm	91	48	28	92	22	22	81	19	97	72	24	12	45	85	96	64	97	43
Total	212	168	40	111	66	44	113	56	145	144	36	39	157	97	124	225	130	124
Nanoflagellates																		
2-5μm	181	314	73	1226	1160	483	902	9352	5701	1642	17600	39700	2530	16800	57500	4910	8610	23300
6-15μm	0	24	8	110	220	180	145	570	245	0	3440	4530	410	1650	3120	200	654	400
coccolithophores										0	1420	805	0	290	680	0	436	161
Total	181	338	81	1336	1380	663	1047	9922	5946	1642	22500	45000	2940	18700	61300	5110	9700	23900

TABLE 8 ZOOPLANKTON (numbers m^{-3}, >200μm) 0-13m

	DAY 1			DAY 3			DAY 5			DAY 8			DAY 10			DAY 12		
	B	C	D	B	C	D	B	C	D	B	C	D	B	C	D	B	C	D
<u>copepods</u>																		
Paracalanus	240	100	80	440	220	100	520	120	20	640	70	18	1400	10	3	1480	0	0
Pseudocalanus	300	120	140	440	200	100	400	100	90	1320	65	20	1920	28	3	4240	23	3
Acartia	160	220	240	220	240	140	280	70	80	200	30	45	100	33	18	120	18	10
Tortanus	20	40	40	0	60	20	120	0	0	80	0	0	40	3	0	40	0	0
Centropages	0	100	100	260	200	80	120	0	160	40	35	33	20	13	30	40	28	13
Calanus				40			80	10	0	20			60			125		
Corycaeus	240	260	240	180	200	360	120	260	100	340	138	20	300	43	0	340	50	0
Oithona	460	520	480	140	240	60	160	190	130	40	100	38	60	68	15	20	40	0
copepodites	7120	7080	7300	8760	4760	4640	8800	1480	440	6860	288	10	5100	148	20	5720	55	23
nauplii	2100	2580	3180	800	900	840	600	420	200	40	8	38	0	3	3	0	0	18
<u>ctenophores</u>																		
Pleurobrachia	28	58	58	55	10	13	40	13	8	85	3	0	113	0	0	170	0	0
Bolinopsis													8			3		
<u>medusae</u>																		
Philadium	10	8	0	8	3	0	53	0	0	73	0	0	55	0	0	93	0	0
Aglantha	0	8	5	20	10	18	0	0	3	8	0	3	5	10	0	8	0	0
Rathkea													80			45		
Hybocodon																3		
Oikopleura	2100	2500	2560	1200	840	320	2720	670	80	800	63	5	440	80	15	80	5	5
Sagitta	40	40	80	28	13	48	13	35	30	13	13	15	8	15	13	20	8	8
Ostracods	100	60	60	120	80	60	240	40	50	120	28	20	40	3	0	20	3	5
Bivalve larvae	180	180	140	180	120	100	640	140	40	160	158	40	120	78	18	140	100	3
Snail larvae	180	60	60	180	60	20	320	20	20	120	8	18	100	8	3	220	15	0
Polychaetes	610	860	780	880	780	600	2360	670	270	1300	418	243	1260	478	175	2860	648	178
Cladocera	260	840	880	740	1140	1040	280	320	1140	40	298	360	0	98	75	20	93	98
<u>Noctiluca</u> ($x10^3$)	9.4	5.2	8.6	9.4	58.0	107	25.0	150	61.8	22.0	28.8	17.9	42.0	10.3	13.6	29.3	0.8	12.3
others	283	540	400	423	460	363	685	343	330	303	847	240	300	220	230	408	177	165

TABLE 9

PARTICULATE ORGANIC CARBON and NITROGEN

($\mu g\ L^{-1}$)

		DAY 1			DAY 3			DAY 5			DAY 8			DAY 10			DAY 12		
		C	N	C:N	C	N	C:N	C	N	C:N	C	N	C:N	C	N	C:N	C	N	C:N
B	0-5m	244	45.0	5.4	383	76.0	5.0	276	50.5	5.4	327	60.5	5.4	377	64.6	5.8	419	80.3	5.2
	5-10m	214	40.6	5.3	352	73.5	4.8	254	45.9	5.5	252	46.9	5.4	268	50.5	5.3	223	43.4	5.1
	10-13m	238	45.3	5.3	183	35.2	5.2	208	39.1	5.3	233	44.1	5.3	173	33.4	5.2	167	29.5	5.7
	0-13m	231	43.4		325	65.6		252	46.1		276	51.5		288	52.0		285	54.4	
C	0-5m	225	33.3	6.8	413	75.7	5.5	316	50.3	6.3	422	66.8	6.3	432	66.6	6.5	324	43.8	7.4
	5-10m	303	44.8	6.8	309	61.0	5.1	413	69.9	5.9	364	60.8	6.0	309	48.5	6.4	259	38.5	6.7
	10-13m	276	40.8	6.8	267	52.4	5.1	381	71.1	5.4	481	83.7	5.7	386	64.6	6.0	315	49.3	6.4
	0-13m	267	39.5		339	64.7		368	62.6		413	68.4		374	59.2		297	43.0	
D	0-5m	232	41.6	5.6	488	87.0	5.6	374	63.2	5.9	628	91.8	6.8	503	70.5	7.1	350	44.8	7.8
	5-10m	229	41.7	5.5	445	78.3	5.7	412	69.1	5.9	362	60.2	6.0	362	55.7	6.5	320	43.6	7.3
	10-13m	286	58.6	4.9	561	110	5.1	517	95.7	5.4	305	59.0	5.2	421	71.5	5.9	456	67.5	6.8
	0-13m	243	45.6		488	89.0		422	72.9		451	72.1		430	65.0		363	49.6	

TABLE 10 SEDIMENTED MATERIAL

		$mgC\ d^{-1}$	$mgN\ d^{-1}$	C:N	mg C (cumulative)	mg N (cumulative)
DAY 2	B	833	124	6.73	833	124
	C	1712	294	5.82	1712	294
	D	1926	321	6.00	1926	321
DAY 3	B	1197	179	6.68	2030	303
	C	1681	-	-	3393	579*
	D	1836	292	6.30	3762	613
DAY 4	B	1470	187	7.85	3500	490
	C	2892	479	6.04	6285	1058
	D	3972	645	6.16	7734	1258
DAY 5	B	655	91.2	7.18	4155	581
	C	1211	184	6.58	7496	1242
	D	1686	256	6.58	9420	1514
DAY 6	B	823	124	6.63	4978	705
	C	1717	277	6.20	9213	1519
	D	2447	409	5.99	11867	1923
DAY 7	B	601	93.3	6.45	5579	799
	C	2349	418	5.61	11562	1937
	D	2095	324	6.47	13962	2247
DAY 8	B	812	121	6.72	6391	920
	C	2769	453	6.12	14331	2390
	D	1517	236	6.42	15479	2483
DAY 9	B	471	77.7	6.06	6862	997
	C	1255	207	6.05	15586	2597
	D	574	88.4	6.49	16053	2571
DAY 10	B	457	72.0	6.35	7319	1069
	C	1651	325	5.08	17237	2922
	D	388	67.1	5.79	16441	2639
DAY 11	B	317	48.8	6.49	7636	1118
	C	1185	206	5.75	18422	3128
	D	504	80.8	6.24	16945	2719
DAY 12	B	515	74.9	6.82	8147	1193
	C-1	1110	194	5.72	19704	3336
	C-2	1454	223	6.53		
	D-1	724	117	6.18	17824	2937
	D-2	1034	149	6.94		

*value estimated from C:N ratio.

TABLE 11

ATP(μg/1) JULY 1981

DAY	CONTROL BAG 1 m	CONTROL BAG 12 m	Cu BAG 1 m	Cu BAG 12 m	Cu+DOC BAG 1 m	Cu+DOC BAG 12 m
1 am	1.5	0.68	0.95	0.83	2.3	0.66
1 pm	0.69	0.53	1.7	0.62	0.61	0.37
2 am	1.3	0.38	0.15	0.23	0.45	0.54
2 pm	0.25	0.84	0.63	3.1	0.35	0.26
3 am	2.4	0.23	0.37	1.0	2.1	0.13
3 pm	0.47	0.18	0.20	0.28	0.33	0.055
4 am	0.71	0.10	0.18	0.62	0.96	0.10
4 pm	2.2	4.9	4.2	2.1	2.2	2.6
5 am	0.27	1.1	2.6	2.5	1.5	1.5
5 pm	0.15	1.3	1.6	1.9	1.5	1.1
6 am	1.3	0.33	0.17	0.38	0.15	0.080
6 pm	2.4	0.37	0.15	0.080	0.16	0.50
7 am	0.63	0.13	0.15	1.6	0.41	0.41
7 pm	0.49	0.32	0.40	0.62	0.51	0.77
8 am	8.3	4.8	4.9	9.1	1.1	4.1
8 pm	2.6	2.6	3.2	3.0	0.86	0.69
9 am	1.0	0.81	1.2	1.0	0.92	0.18
9 pm	1.2	0.84	1.3	0.56	0.29	0.18
10 am	0.92	0.92	1.2	0.82	0.29	0.26
10 pm	0.26	0.18	0.81	0.33	0.62	0.080
11 am	2.3	0.59	0.49	0.43	0.31	0.18
11 pm	0.62	0.32	0.35	0.77	0.59	0.12
12 am	7.3	0.31	0.66	0.38	0.30	0.13
12 pm	3.2	1.3	0.51	1.4	0.91	0.63

TABLE 12

CARBOHYDRATES (mg/1) DISSOLVED JULY 1981

DAY	CONTROL BAG		Cu BAG		Cu+DOC BAG	
	0-5m	10-13m	0-5m	10-13m	0-5m	10-13m
1 am	0.18	0.19	0.38	0.23	0.23	0.27
2 am	0.16	0.17	0.22	0.14	3.88	4.10
3 am	0.46	0.30	0.36	0.43	1.64	1.48
4 am	0.46	0.33	0.54	0.45	0.47	0.38
5 am	0.24	0.25	0.58	0.42	0.25	0.22
6 am	0.16	0.43	0.35	0.42	0.25	0.095
7 am	0.46	0.58	0.40	0.21	0.20	0.45
8 am	0.52	0.49	0.36	0.27	0.17	0.36
9 am	0.50	0.38	0.37	0.30	0.26	0.28
10 am	0.35	0.26	0.12	0.12	0.26	0.28
11 am	0.25	0.26	0.26	0.33	0.35	0.18
12 am	0.20	0.17	0.41	0.39	0.16	0.25

TABLE 13

TOTAL BACTERIA (/ml) JULY 1981

DAY	CONTROL BAG 1 m	CONTROL BAG 12 m	Cu BAG 1 m	Cu BAG 12 m	Cu+ DOC BAG 1 m	Cu+ DOC BAG 12 m
1 am	$1.5x10^{7}$	$6.3x10^{6}$	$8.8x10^{6}$	$6.3x10^{6}$	$1.3x10^{7}$	$6.3x10^{6}$
1 pm	$1.0x10^{7}$	$5.0x10^{6}$	$1.0x10^{6}$	$5.0x10^{6}$	$7.5x10^{6}$	$5.0x10^{6}$
2 am	$1.3x10^{6}$	$7.5x10^{6}$	$1.8x10^{6}$	$8.8x10^{6}$	$1.9x10^{6}$	1.9x106
2 pm	$2.0x10^{7}$	$2.4x10^{7}$	$1.1x10^{7}$	$1.6x10^{7}$	$1.1x10^{7}$	$1.0x10^{7}$
3 am	$1.1x10^{7}$	$1.9x10^{7}$	$1.3x10^{7}$	$1.0x10^{7}$	$2.1x10^{7}$	$1.8x10^{7}$
3 pm	$2.1x10^{7}$	$2.0x10^{7}$	$1.8x10^{7}$	$2.0x10^{7}$	$2.3x10^{7}$	$3.4x10^{7}$
4 am	$1.4x10^{7}$	$2.6x10^{7}$	$1.5x10^{7}$	$1.4x10^{7}$	$3.3x10^{7}$	$4.8x10^{7}$
4 pm	$1.1x10^{7}$	$1.9x10^{7}$	$2.6x10^{7}$	$1.5x10^{7}$	$2.1x10^{7}$	$3.0x10^{7}$
5 am	$1.4x10^{7}$	$2.5x10^{7}$	$1.5x10^{7}$	$1.6x10^{7}$	$1.4x10^{7}$	$1.0x10^{7}$
5 pm	$1.4x10^{7}$	$1.8x10^{7}$	$1.1x10^{7}$	$1.4x10^{7}$	$1.9x10^{7}$	$8.8x10^{6}$
6 am	$2.8x10^{7}$	$2.3x10^{7}$	$2.1x10^{7}$	$2.4x10^{7}$	$2.1x10^{7}$	$1.3x10^{7}$
6 pm	$1.1x10^{7}$	$1.5x10^{7}$	$1.6x10^{7}$	$1.4x10^{7}$	$2.6x10^{7}$	$1.4x10^{7}$
7 am	$1.8x10^{7}$	$2.4x10^{7}$	$1.9x10^{7}$	$2.3x10^{7}$	$2.0x10^{7}$	$1.9x10^{7}$
7 pm	$1.8x10^{7}$	$1.0x10^{7}$	$1.5x10^{7}$	$7.5x10^{6}$	$6.3x10^{6}$	$1.1x10^{6}$
8 am	$2.3x10^{7}$	$1.0x10^{7}$	$1.5x10^{7}$	$7.5x10^{6}$	$1.9x10^{7}$	$2.0x10^{7}$
8 pm	$2.3x10^{7}$	$1.8x10^{7}$	$1.0x10^{7}$	$1.5x10^{7}$	$1.8x10^{7}$	$1.1x10^{7}$
9 am	$7.5x10^{6}$	$3.8x10^{6}$	$7.5x10^{6}$	$8.8x10^{6}$	$1.8x10^{7}$	$1.5x10^{7}$
9 pm	$2.0x10^{7}$	$1.0x10^{7}$	$1.1x10^{7}$	$1.0x10^{7}$	$2.1x10^{7}$	$1.8x10^{7}$
10 am	$1.9x10^{7}$	$8.8x10^{6}$	$1.5x10^{7}$	$1.4x10^{7}$	$7.5x10^{6}$	$8.8x10^{6}$
10 pm	$1.8x10^{7}$	$1.1x10^{7}$	$1.5x10^{7}$	$1.9x10^{7}$	$2.8x10^{7}$	$1.8x10^{7}$
11 am	$1.3x10^{7}$	$1.1x10^{7}$	$1.0x10^{7}$	$7.5x10^{6}$	$5.0x10^{6}$	$1.0x10^{7}$
11 pm	$8.8x10^{6}$	$1.5x10^{7}$	$1.4x10^{7}$	$2.3x10^{7}$	$2.1x10^{7}$	$1.5x10^{7}$
12 am	$1.1x10^{7}$	$1.4x10^{7}$	$1.4x10^{7}$	$1.0x10^{7}$	$7.5x10^{6}$	$8.8x10^{6}$
12 pm	$1.0x10^{7}$	$1.1x10^{7}$	$5.0x10^{6}$	$8.8x10^{6}$	$7.5x10^{6}$	$1.0x10^{7}$

TABLE 14 UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 1 DEPTH: 1m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid	0.49	59	121	33	0.27	38
Galactose	0.021	7.6	360	3.1	0.0086	10
Glycollic acid	0.016	12	738	1.9	0.0026	34
PM: Glutamic acid	0.18	48	268	26	0.097	44
Galactose	0.070	16	227	8.1	0.036	37
Glycollic acid	0.0079	12	1514	2.0	0.0013	37
Cu BAG						
AM: Glutamic acid	0.25	18	72	10	0.14	27
Galactose	0.017	3.7	222	1.4	0.0063	7.7
Glycollic acid	0.024	10	417	7.1	0.017	20
PM: Glutamic acid	0.33	24	73	11	0.15	48
Galactose	0.041	45	1094	7.2	0.0066	40
Glycollic acid	0.021	22	1054	8.7	0.0083	49
Cu+DOC BAG						
AM Glutamic acid	0.53	18	34	4.2	0.12	34
Galactose	0.050	5.2	105	1.4	0.013	15
Glycollic acid	0.037	15	405	11	0.027	22
PM: Glutamic acid	0.11	15	134	5.5	0.041	30
Galactose	0.020	19	965	2.1	0.0022	35
Glycollic acid	0.027	18	663	15	0.023	65

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 1 DEPTH: 12m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid	0.24	33	139	21	0.15	28
Galactose	0.018	5.1	288	0.9	0.0031	8.6
Glycollic acid	0.030	9.2	302	4.8	0.016	23
PM: Glutamic acid	0.088	29	329	21	0.064	46
Galactose	0.021	7.7	362	1.3	0.0036	49
Glycollic acid	0.020	11	564	6.3	0.011	29
Cu BAG						
AM: Glutamic acid	0.14	13	90	5.9	0.066	21
Galactose	0.020	5.2	262	1.1	0.0042	19
Glycollic acid	0.023	12	521	7.9	0.015	47
PM: Glutamic acid	0.25	17	68	6.1	0.090	33
Galactose	0.016	11	696	2.0	0.0029	32
Glycollic acid	0.015	17	1144	1.5	0.0013	52
Cu+DOC BAG						
AM Glutamic acid	0.21	10	47	2.5	0.053	36
Galactose	0.030	6.7	221	2.9	0.013	15
Glycollic acid	0.021	8.5	408	2.3	0.0056	39
PM: Glutamic acid	0.051	8.1	159	2.1	0.013	17
Galactose	0.0073	7.9	1081	2.3	0.0021	38
Glycollic acid	0.010	24	2360	6.0	0.0025	48

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 2 DEPTH: 1m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid	0.16	42	256	28	0.11	27
Galactose	0.027	35	1290	23	0.018	29
Glycollic acid	0.0062	11	1782	5.9	0.0033	40
PM: Glutamic acid			118			66
Galactose			448			53
Glycollic acid			816			51
Cu BAG						
AM: Glutamic acid	0.040	30	746	12	0.016	56
Galactose	0.028	66	2334	5.2	0.0022	38
Glycollic acid	0.013	41	3254	9.4	0.0029	27
PM: Glutamic acid			230			34
Galactose			2484			45
Glycollic acid			3695			49
Cu+DOC BAG						
AM Glutamic acid	0.13	18	142	8.8	0.062	56
Galactose	0.011	16	1435	3.1	0.0022	33
Glycollic acid	0.012	31	2612	19	0.0073	39
PM: Glutamic acid			311			66
Galactose			2566			55
Glycollic acid			4227			44

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 2 DEPTH: 12m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation (%)
CONTROL						
AM: Glutamic acid	0.055	22	400	10	0.025	31
Galactose	0.013	21	1571	11	0.0070	17
Glycollic acid	0.0058	15	2592	8.4	0.0032	29
PM: Glutamic acid			346			64
Galactose			1454			44
Glycollic acid			1083			26
Cu BAG						
AM: Glutamic acid	0.072	12	166	7.3	0.044	44
Galactose	0.027	28	1042	10	0.0096	31
Glycollic acid	0.011	22	2076	2.8	0.0013	38
PM: Glutamic acid			134			42
Galactose			1909			34
Glycollic acid			2595			58
Cu+DOC BAG						
AM Glutamic acid	0.029	7.9	275	2.3	0.0084	48
Galactose	0.0032	8.1	2499	2.2	0.00088	29
Glycollic acid	0.0077	23	3006	5.7	0.0019	27
PM: Glutamic acid			131			25
Galactose			1240			34
Glycollic acid			715			50

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 3

DEPTH: 1m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid	0.11	21	193	5.3	0.027	46
Galactose	0.021	19	893	6.1	0.0068	31
Glycollic acid	0.019	33	1706	11	0.0064	41
PM: Glutamic acid			81			53
Galactose			153			45
Glycollic acid			394			40
Cu BAG						
AM: Glutamic acid	0.059	42	713	18	0.025	44
Galactose	0.012	44	3572	4.2	0.0012	48
Glycollic acid	0.0056	27	4806	12	0.0025	25
PM: Glutamic acid			143			63
Galactose			1713			33
Glycollic acid			662			45
Cu+DOC BAG						
AM Glutamic acid	0.068	121	1771	7.4	0.0042	46
Galactose	0.0085	41	4834	24	0.0050	43
Glycollic acid	0.015	37	2532	21	0.0083	31
PM: Glutamic acid			198			50
Galactose			3117			53
Glycollic acid			1753			62

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 3

DEPTH: 12m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid	0.13	33	260	3.4	0.013	37
Galactose	0.014	23	1623	1.7	0.0010	30
Glycollic acid	0.016	12	764	2.8	0.0037	42
PM: Glutamic acid			122			48
Galactose			601			36
Glycollic acid			578			52
Cu BAG						
AM: Glutamic acid	0.31	37	119	15	0.13	53
Galactose	0.014	28	2063	3.1	0.0015	34
Glycollic acid	0.0085	24	2828	2.2	0.00078	15
PM: Glutamic acid			523			66
Galactose			6083			48
Glycollic acid			656			56
Cu+DOC BAG						
AM Glutamic acid	0.11	41	370	9.7	0.026	69
Galactose	0.011	39	3677	16	0.0044	46
Glycollic acid	0.0062	19	3054	6.6	0.0022	60
PM: Glutamic acid			1204			43
Galactose			3600			70
Glycollic acid			3074			42

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 4

DEPTH: 1m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid	0.33	34	102	8.8	0.086	53
Galactose	0.096	54	562	8.9	0.016	48
Glycollic acid	0.032	33	1041	25	0.024	66
PM: Glutamic acid			212			79
Galactose			1178			55
Glycollic acid			3226			89
Cu BAG						
AM: Glutamic acid	0.18	22	120	16	0.13	51
Galactose	0.027	42	1576	28	0.018	36
Glycollic acid	0.027	22	826	18	0.022	46
PM: Glutamic acid			161			26
Galactose			640			18
Glycollic acid			499			61
Cu+DOC BAG						
AM Glutamic acid	0.048	5.9	123	3.7	0.030	40
Galactose	0.011	4.3	406	0.8	0.0020	40
Glycollic acid	0.11	114	1017	26	0.026	75
PM: Glutamic acid			55			62
Galactose			259			44
Glycollic acid			2446			73

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 4 DEPTH: 12m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation (%)
CONTROL						
AM: Glutamic acid	0.50	72	145	3.4	0.023	56
Galactose	0.15	63	429	7.2	0.017	62
Glycollic acid	0.042	48	1152	26	0.023	67
PM: Glutamic acid			254			41
Galactose			679			19
Glycollic acid			1281			78
Cu BAG						
AM: Glutamic acid	0.24	15	63	11	0.17	44
Galactose	0.041	34	839	8.1	0.0097	25
Glycollic acid	0.059	22	376	6.1	0.016	62
PM: Glutamic acid			41			80
Galactose			469			8.8
Glycollic acid			909			87
Cu+DOC BAG						
AM Glutamic acid	0.066	20	301	2.6	0.0086	75
Galactose	0.011	69	6394	1.3	0.00020	33
Glycollic acid	0.068	143	2110	41	0.019	53
PM: Glutamic acid			233			82
Galactose			816			66
Glycollic acid			2156			95

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 5 DEPTH: 1m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid	0.51	20	392	2.6	0.0066	60
Galactose	0.35	84	238	12	0.050	30
Glycollic acid	0.0065	14	2161	3.9	0.0018	82
PM: Glutamic acid			162			34
Galactose			114			80
Glycollic acid			473			68
Cu BAG						
AM: Glutamic acid	0.52	17	33	7.3	0.22	26
Galactose	0.093	34	364	8.5	0.023	19
Glycollic acid	0.054	9.2	170	4.9	0.029	72
PM: Glutamic acid			78			34
Galactose			280			56
Glycollic acid			650			72
Cu+DOC BAG						
AM Glutamic acid	0.44	15	34	4.3	0.13	38
Galactose	0.026	8.1	312	1.1	0.0035	56
Glycollic acid	0.095	120	1261	13	0.010	90
PM: Glutamic acid			29			50
Galactose			142			74
Glycollic acid			987			95

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 5

DEPTH: 12m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation (%)
CONTROL						
AM: Glutamic acid	0.070	34	488	12	0.025	52
Galactose	0.029	50	1726	9.4	0.0054	44
Glycollic acid	0.013	14	1062	3.8	0.0036	83
PM: Glutamic acid			435			33
Galactose			1385			69
Glycollic acid			830			93
Cu BAG						
AM: Glutamic acid	0.31	17	55	7.7	0.14	50
Galactose	0.033	38	1156	6.5	0.0056	19
Glycollic acid	0.015	7.4	507	4.3	0.0084	85
PM: Glutamic acid			21			49
Galactose			419			44
Glycollic acid			241			63
Cu+DOC BAG						
AM Glutamic acid	0.14	25	183	3.9	0.021	54
Galactose	0.033	40	1205	3.5	0.0029	69
Glycollic acid	0.011	36	3321	11	0.0033	76
PM: Glutamic acid			198			42
Galactose			806			74
Glycollic acid			3224			78

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 6

DEPTH: 1m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation (%)
CONTROL						
AM: Glutamic acid	0.36	35	93	4.5	0.046	64
Galactose	0.063	34	541	3.9	0.0072	73
Glycollic acid	0.050	38	767	2.2	0.0029	88
PM: Glutamic acid			197			59
Galactose			461			47
Glycollic acid			924			84
Cu BAG						
AM: Glutamic acid	0.029	8.6	301	8.1	0.027	50
Galactose	0.014	16	1111	7.4	0.0067	62
Glycollic acid	0.028	14	498	3.3	0.0066	80
PM: Glutamic acid			150			16
Galactose			471			46
Glycollic acid			962			75
Cu+DOC BAG						
AM Glutamic acid	1.3	31	23	3.2	0.14	37
Galactose	0.036	16	443	4.1	0.0093	67
Glycollic acid	0.086	26	303	7.6	0.025	87
PM: Glutamic acid			38			37
Galactose			305			22
Glycollic acid			1389			95

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 6 DEPTH: 12m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation (%)
CONTROL						
AM: Glutamic acid	0.45	48	107	11	0.10	74
Galactose	0.029	23	799	10	0.013	50
Glycollic acid	0.058	40	693	11	0.016	93
PM: Glutamic acid			155			29
Galactose			1245			16
Glycollic acid			797			95
Cu BAG						
AM: Glutamic acid	0.21	14	66	6.5	0.098	24
Galactose	0.037	26	707	2.9	0.0041	63
Glycollic acid	0.028	8.8	319	3.7	0.012	79
PM: Glutamic acid			62			16
Galactose			260			35
Glycollic acid			390			81
Cu+DOC BAG						
AM Glutamic acid	0.64	41	64	3.5	0.055	51
Galactose	0.028	8.8	320	2.8	0.0088	73
Glycollic acid	0.31	26	85	4.3	0.051	89
PM: Glutamic acid			184			37
Galactose			997			21
Glycollic acid			304			83

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 7

DEPTH: 1m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid			273			67
Galactose			464			67
Glycollic acid			856			89
PM: Glutamic acid			118			53
Galactose			325			65
Glycollic acid			707			70
Cu BAG						
AM: Glutamic acid			157			20
Galactose			217			75
Glycollic acid			801			91
PM: Glutamic acid			330			36
Galactose			997			67
Glycollic acid			322			66
Cu+DOC BAG						
AM Glutamic acid			189			43
Galactose			460			74
Glycollic acid			2577			85
PM: Glutamic acid			126			48
Galactose			304			80
Glycollic acid			1100			91

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 7 DEPTH: 12m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid			314			45
Galactose			384			70
Glycollic acid			1404			90
PM: Glutamic acid			207			48
Galactose			567			51
Glycollic acid			1314			68
Cu BAG						
AM: Glutamic acid			95			21
Galactose			3116			53
Glycollic acid			682			83
PM: Glutamic acid			159			38
Galactose			541			47
Glycollic acid			194			70
Cu+DOC BAG						
AM Glutamic acid			230			46
Galactose			550			64
Glycollic acid			1049			93
PM: Glutamic acid			368			47
Galactose			1665			52
Glycollic acid			1308			75

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 8 DEPTH: 1m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid	0.16	26	165	8.4	0.051	48
Galactose	0.018	23	1295	7.5	0.0058	53
Glycollic acid	0.022	26	1180	4.2	0.0036	91
PM: Glutamic acid			147			68
Galactose			871			56
Glycollic acid			843			89
Cu BAG						
AM: Glutamic acid	0.019	7.5	398	3.4	0.0085	29
Galactose	0.019	36	1872	7.1	0.0038	56
Glycollic acid	0.012	4.2	363	1.3	0.0036	59
PM: Glutamic acid			145			19
Galactose			705			47
Glycollic acid			346			74
Cu+DOC BAG						
AM Glutamic acid	0.54	45	84	19	0.23	18
Galactose	0.010	29	2912	6.7	0.0023	55
Glycollic acid	0.040	110	2770	11	0.0040	64
PM: Glutamic acid			75			57
Galactose			2154			57
Glycollic acid			705			85

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 8 DEPTH: 12m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid	0.079	12	151	9.1	0.060	43
Galactose	0.022	17	773	6.0	0.0078	48
Glycollic acid	0.032	18	560	4.2	0.0075	59
PM: Glutamic acid			113			41
Galactose			1593			57
Glycollic acid			754			84
Cu BAG						
AM: Glutamic acid	0.057	17	300	8.3	0.028	45
Galactose	0.029	25	869	5.2	0.0060	52
Glycollic acid	0.076	32	422	7.6	0.018	85
PM: Glutamic acid			122			44
Galactose			457			61
Glycollic acid			125			83
Cu+DOC BAG						
AM Glutamic acid	0.10	37	362	12	0.033	52
Galactose	0.0095	34	3591	2.0	0.00056	47
Glycollic acid	0.044	33	750	1.2	0.0016	71
PM: Glutamic acid			400			54
Galactose			2473			63
Glycollic acid			478			82

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 9

DEPTH: 12m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid			178			42
Galactose			1189			62
Glycollic acid			485			62
PM: Glutamic acid			142			57
Galactose			1254			22
Glycollic acid			231			54
Cu BAG						
AM: Glutamic acid			61			40
Galactose			1009			45
Glycollic acid			775			61
PM: Glutamic acid			46			47
Galactose			1387			44
Glycollic acid			406			61
Cu+DOC BAG						
AM Glutamic acid			58			45
Galactose			2765			62
Glycollic acid			769			60
PM: Glutamic acid			52			59
Galactose			4225			72
Glycollic acid			341			28

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 9 DEPTH: 12m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid			161			54
Galactose			2611			57
Glycollic acid			1051			74
PM: Glutamic acid			163			40
Galactose			863			60
Glycollic acid			1482			43
Cu BAG						
AM: Glutamic acid			55			24
Galactose			939			66
Glycollic acid			615			77
PM: Glutamic acid			36			34
Galactose			1075			43
Glycollic acid			196			79
Cu+DOC BAG						
AM Glutamic acid			468			58
Galactose			3672			57
Glycollic acid			1028			66
PM: Glutamic acid			310			49
Galactose			2471			68
Glycollic acid			541			57

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 10 DEPTH: 1m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid	0.17	21	126	3.1	0.025	42
Galactose	0.022	18	801	2.8	0.0035	52
Glycollic acid	0.014	16	1114	1.1	0.00099	55
PM: Glutamic acid			254			71
Galactose			1310			70
Glycollic acid			1465			60
Cu BAG						
AM: Glutamic acid	0.82	46	56	9.6	0.17	38
Galactose	0.019	24	1261	2.4	0.0019	50
Glycollic acid	0.031	18	585	5.1	0.0087	68
PM: Glutamic acid			218			33
Galactose			4610			55
Glycollic acid			1116			73
Cu+DOC BAG						
AM Glutamic acid	0.21	24	113	9.9	0.088	17
Galactose	0.0071	29	4058	8.3	0.0020	67
Glycollic acid	0.038	84	2220	12	0.0054	52
PM: Glutamic acid			202			65
Galactose			4589			50
Glycollic acid			855			81

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 10 DEPTH: 12m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation (%)
CONTROL						
AM: Glutamic acid	0.13	21	157	7.2	0.046	56
Galactose	0.014	19	1313	4.1	0.0031	67
Glycollic acid	0.017	15	871	5.8	0.0067	77
PM: Glutamic acid			144			58
Galactose			1709			65
Glycollic acid			792			80
Cu BAG						
AM: Glutamic acid	1.4	46	32	8.9	0.28	40
Galactose	0.066	41	617	5.5	0.0089	61
Glycollic acid	0.029	12	409	2.6	0.0064	75
PM: Glutamic acid			66			40
Galactose			4472			46
Glycollic acid			739			80
Cu+DOC BAG						
AM Glutamic acid	0.13	21	165	6.3	0.038	57
Galactose	0.0062	29	4702	8.2	0.0017	48
Glycollic acid	0.11	46	424	1.3	0.0031	87
PM: Glutamic acid			159			50
Galactose			3379			57
Glycollic acid			872			79

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 11 DEPTH: 1m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid			241			38
Galactose			1398			61
Glycollic acid			1154			61
PM: Glutamic acid			174			51
Galactose			1064			46
Glycollic acid			429			70
Cu BAG						
AM: Glutamic acid			376			44
Galactose			3176			65
Glycollic acid			715			65
PM: Glutamic acid			443			40
Galactose			3593			35
Glycollic acid			1266			65
Cu+DOC BAG						
AM Glutamic acid			153			46
Galactose			5689			66
Glycollic acid			1988			59
PM: Glutamic acid			47			51
Galactose			2240			52
Glycollic acid			1277			42

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 11 DEPTH: 12m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid			198			60
Galactose			333			75
Glycollic acid			915			81
PM: Glutamic acid			146			49
Galactose			1515			54
Glycollic acid			638			72
Cu BAG						
AM: Glutamic acid			136			67
Galactose			1782			64
Glycollic acid			764			78
PM: Glutamic acid			182			51
Galactose			475			47
Glycollic acid			251			70
Cu+DOC BAG						
AM Glutamic acid			101			53
Galactose			3993			75
Glycollic acid			879			81
PM: Glutamic acid			107			56
Galactose			1680			64
Glycollic acid			737			68

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 12 DEPTH: 1m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation (%)
CONTROL						
AM: Glutamic acid	0.091	13	143	4.4	0.031	49
galactose	0.013	15	1187	4.3	0.0036	13
Glycollic acid	0.031	13	425	4.2	0.0099	66
PM: Glutamic acid			166			50
Galactose			583			18
Glycollic acid			727			53
Cu BAG						
AM: Glutamic acid	0.16	20	123	1.6	0.013	39
Galactose	0.0079	15	1898	3.8	0.0020	45
Glycollic acid	0.023	18	796	0.9	0.0011	81
PM: Glutamic acid			161			38
Galactose			339			19
Glycollic acid			250			55
Cu+DOC BAG						
AM Glutamic acid	0.10	15	147	2.6	0.018	24
Galactose	0.013	28	2166	6.5	0.0030	49
Glycollic acid	0.028	51	1792	17	0.0095	67
PM: Glutamic acid			148			50
Galactose			3040			25
Glycollic acid			1343			75

UPTAKE KINETICS OF ORGANIC SUBSTRATES BY MICROORGANISMS

DAY: 12 DEPTH: 12m

Substrate	V ($mg/m^3/hr$)	Kt + Sn (mg/m^3)	Tt (hr)	Sn (mg/m^3)	Vt ($mg/m^3/hr$)	Mineralization / gross assimilation(%)
CONTROL						
AM: Glutamic acid	0.042	7.3	172	1.4	0.0081	50
Galactose	0.031	14	455	4.6	0.010	16
Glycollic acid	0.023	15	649	3.3	0.0051	83
PM: Glutamic acid			333			35
Galactose			942			9.2
Glycollic acid			1266			62
Cu BAG						
AM: Glutamic acid	0.076	9.4	123	3.1	0.025	39
Galactose	0.038	8.9	236	0.6	0.0025	26
Glycollic acid	0.031	10	327	5.8	0.018	76
PM: Glutamic acid			129			41
Galactose			244			23
Glycollic acid			118			65
Cu+DOC BAG						
AM Glutamic acid	0.17	12	171	2.3	0.032	45
Galactose	0.012	35	2950	5.2	0.0018	55
Glycollic acid	0.018	18	1003	4.5	0.0045	94
PM: Glutamic acid			195			54
Galactose			3451			38
Glycollic acid			1386			80

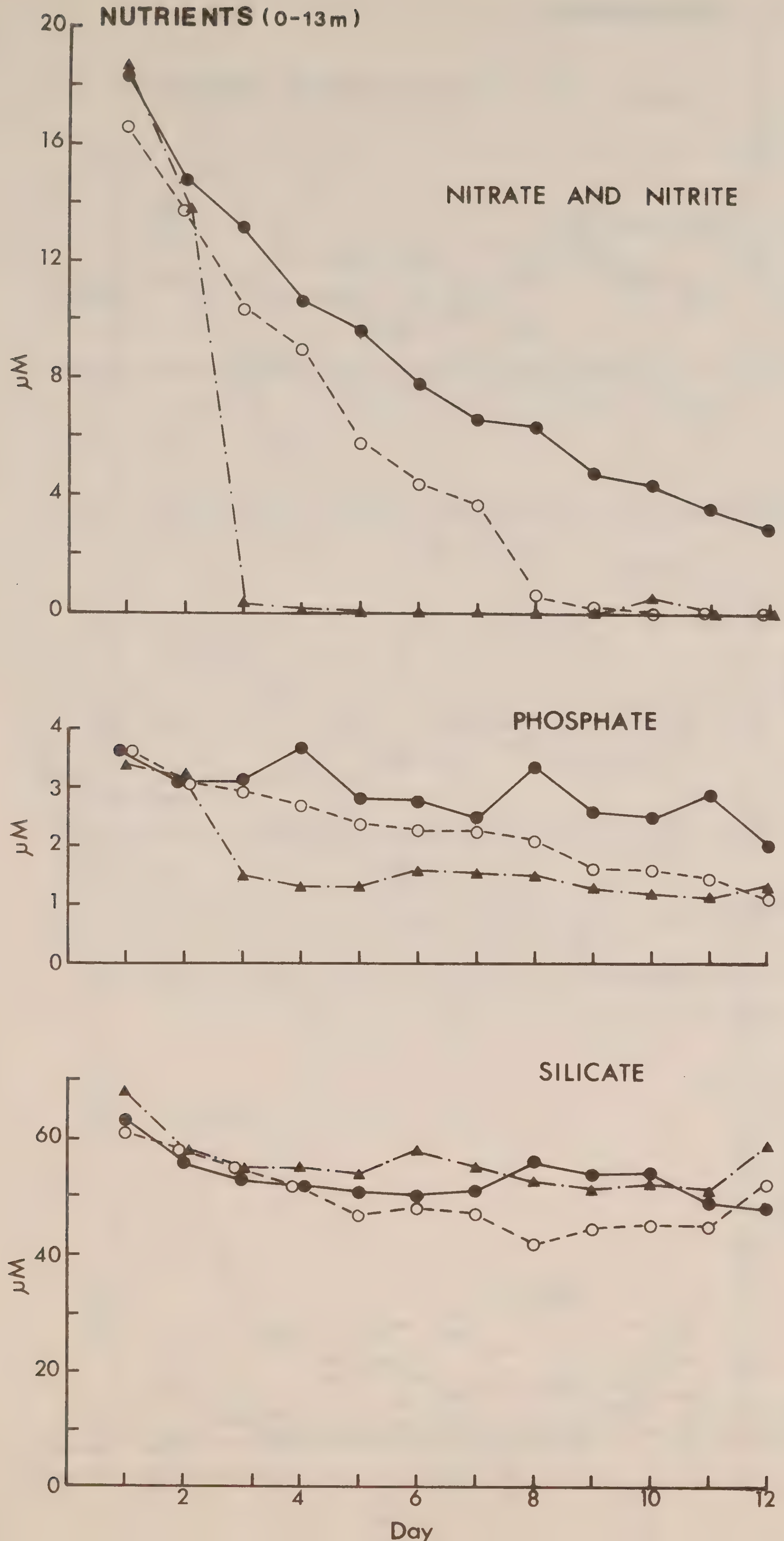
FIGURES

Legend for Figures 1 to 7:

CONTROL	(B)	●——●
Cu Bag	(C)	○- - -○
Cu+DOC	(D)	▲-·-▲

Legend for Figures 9 to 11:

Glutamic Acid	▲——▲
Glycollic Acid	●- - -●
Galactose	■-·-■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12
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20
1
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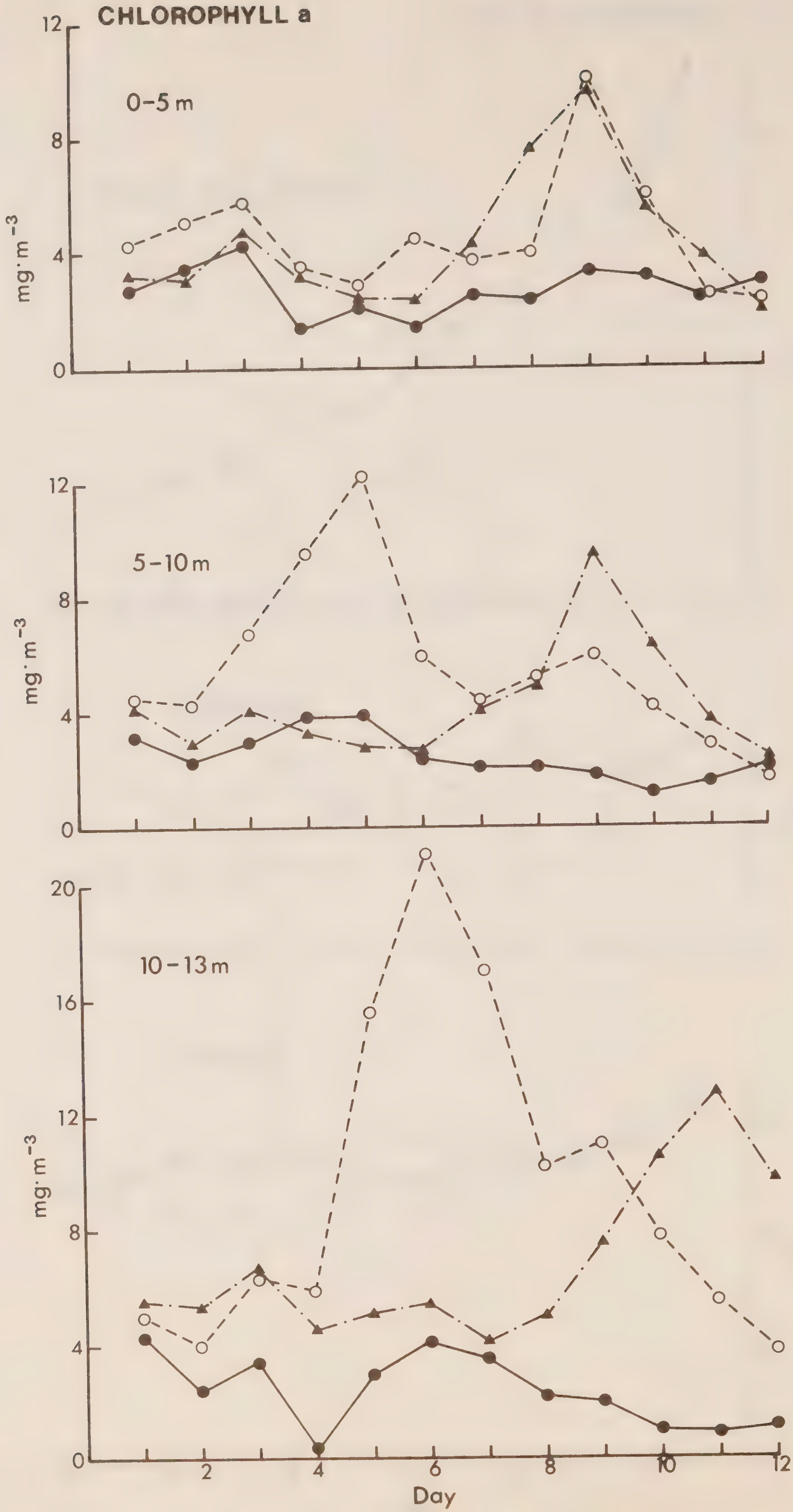
40
60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5-10 m
10-13 m
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4
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12
16
20
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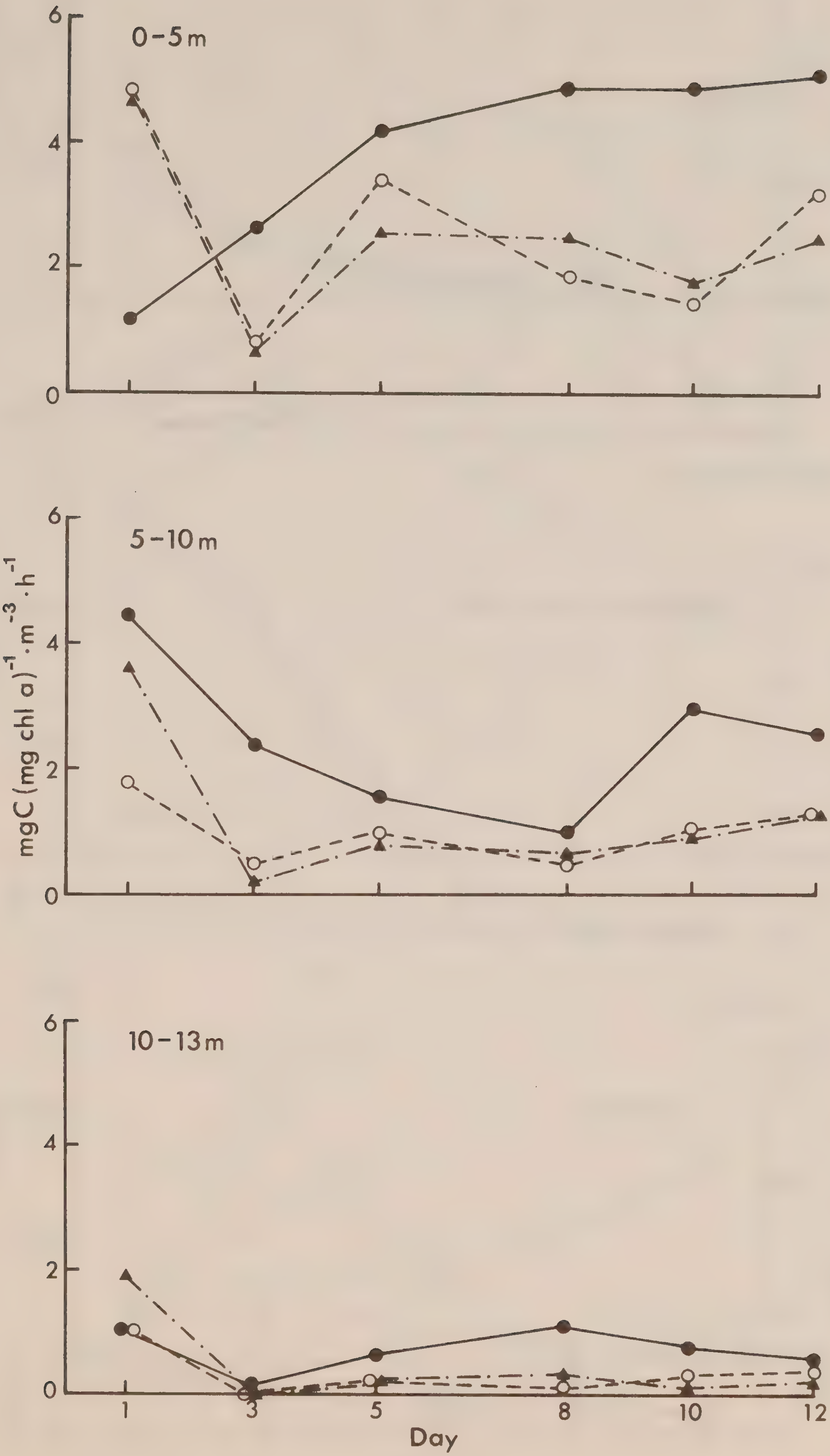
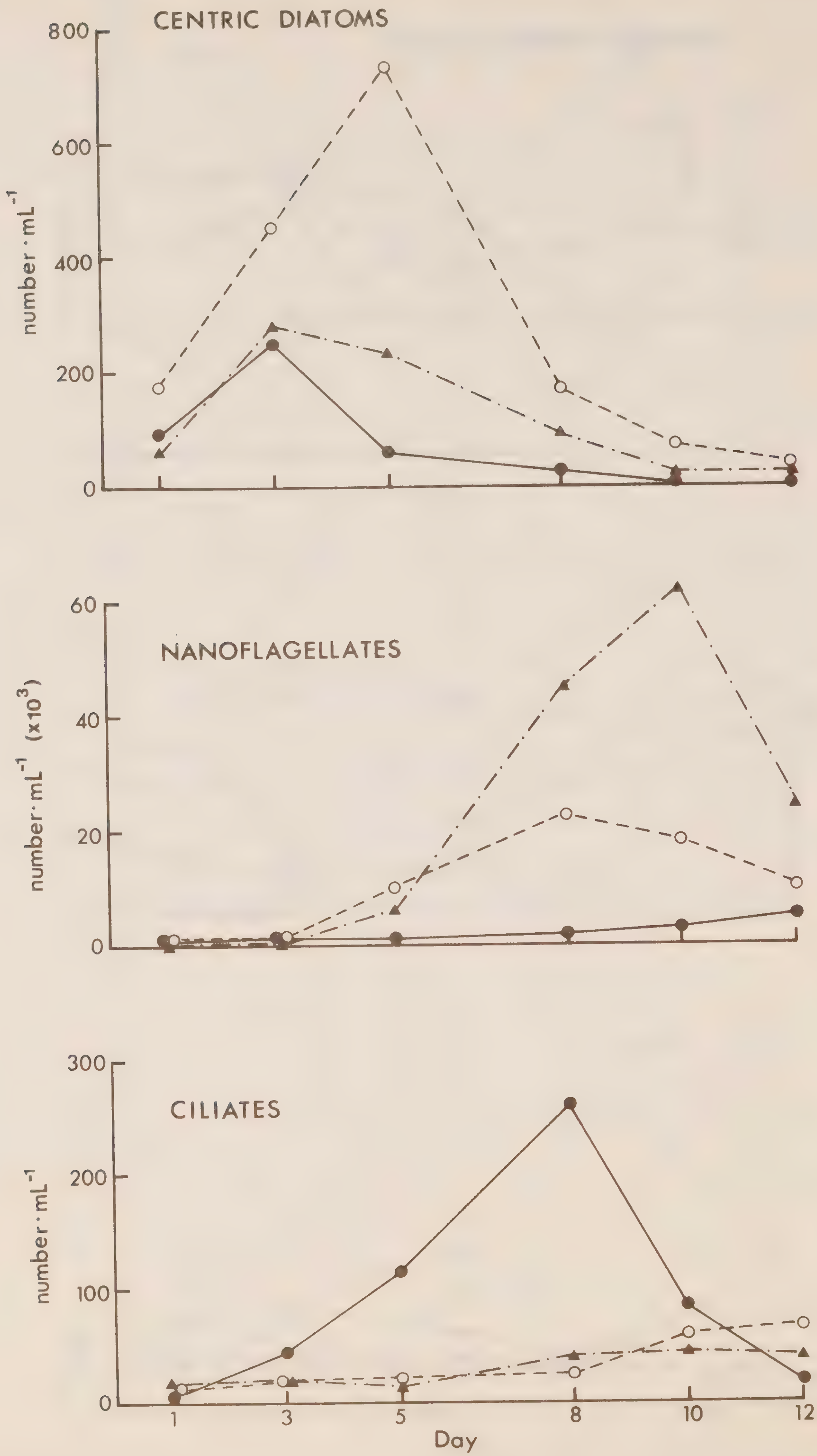
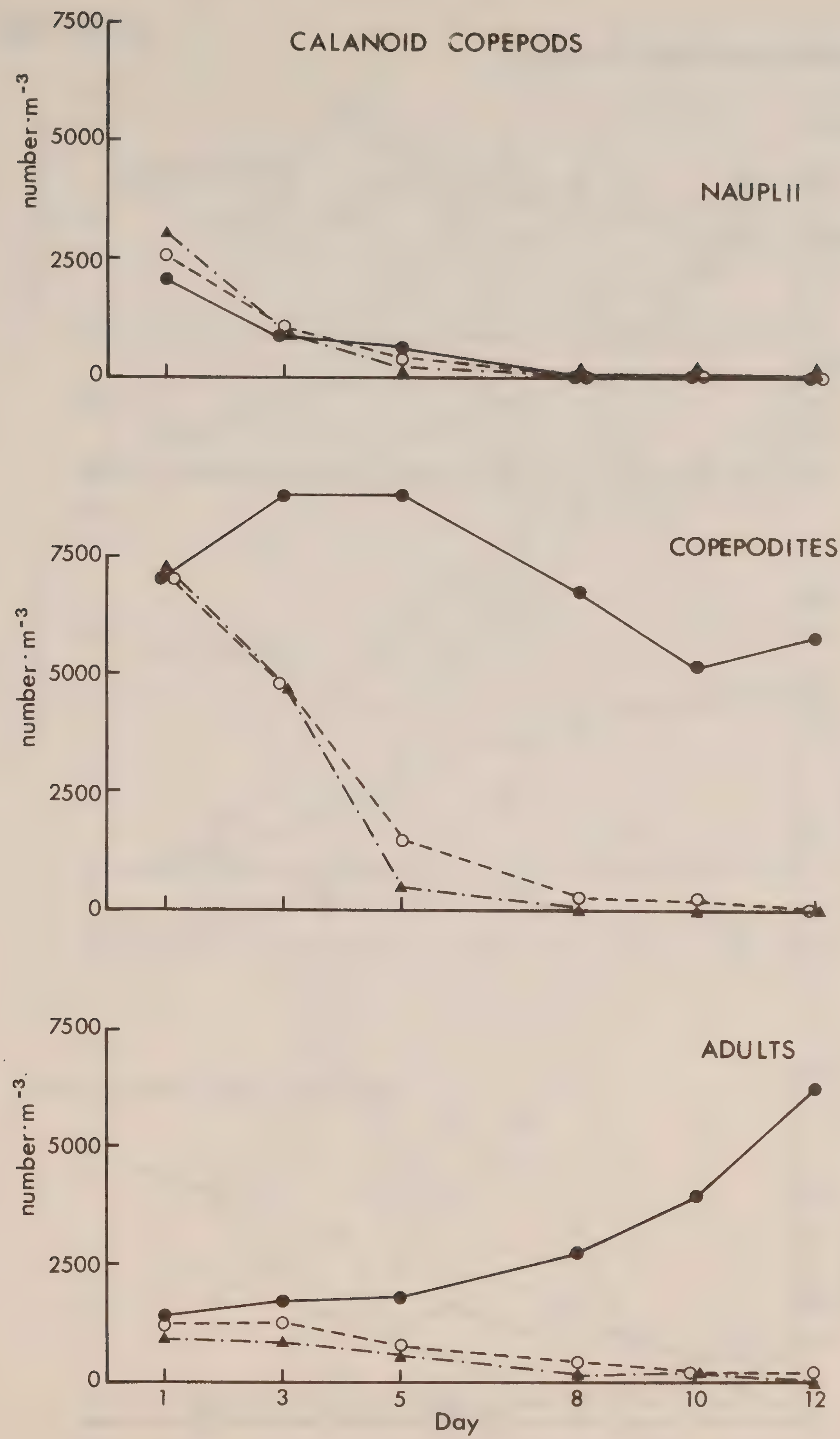
12
Day

PRIMARY PRODUCTIVITY



PHYTOPLANKTON (0-13m)

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NAUPLII
COPEPODITES
ADULTS
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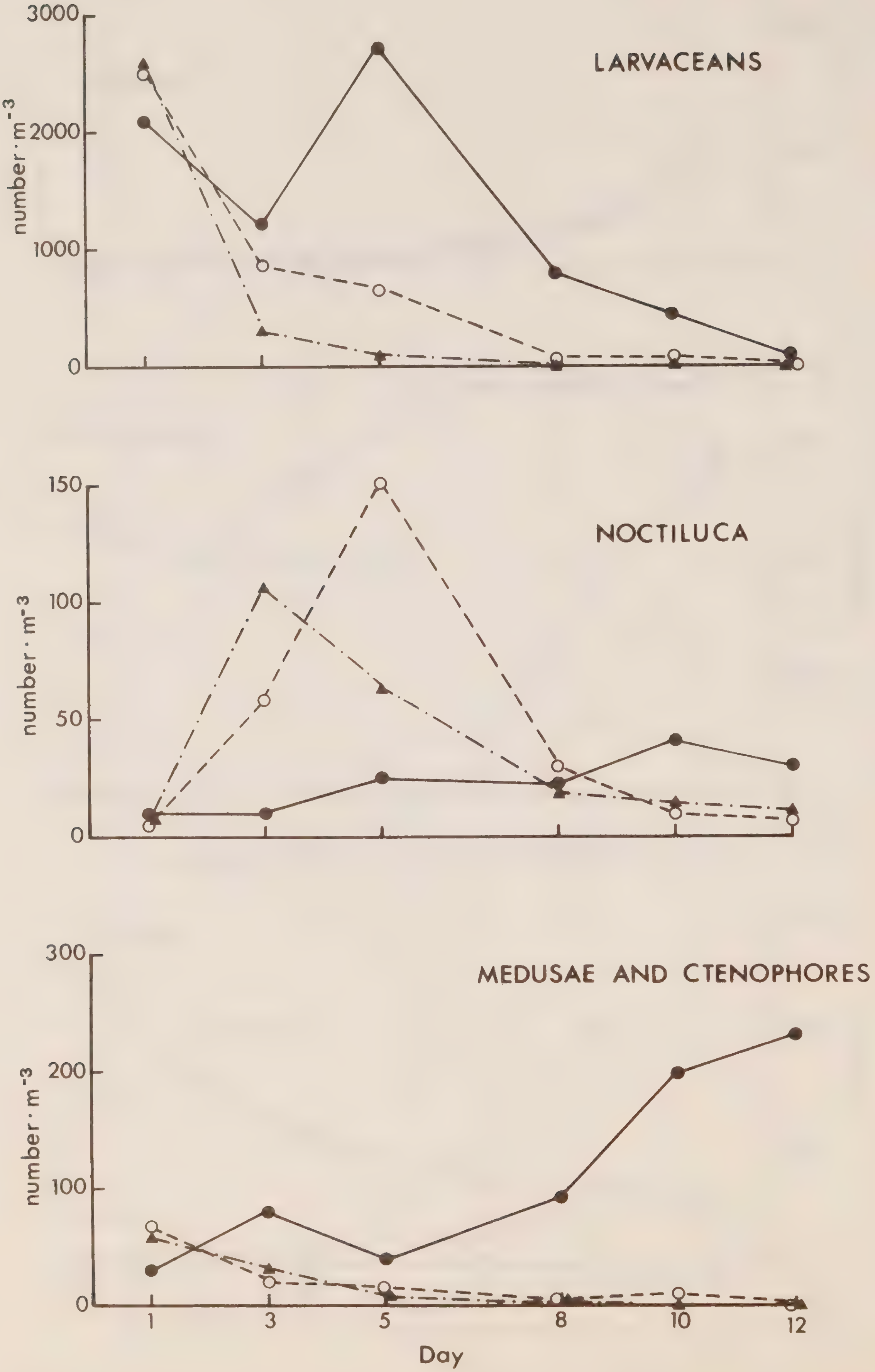
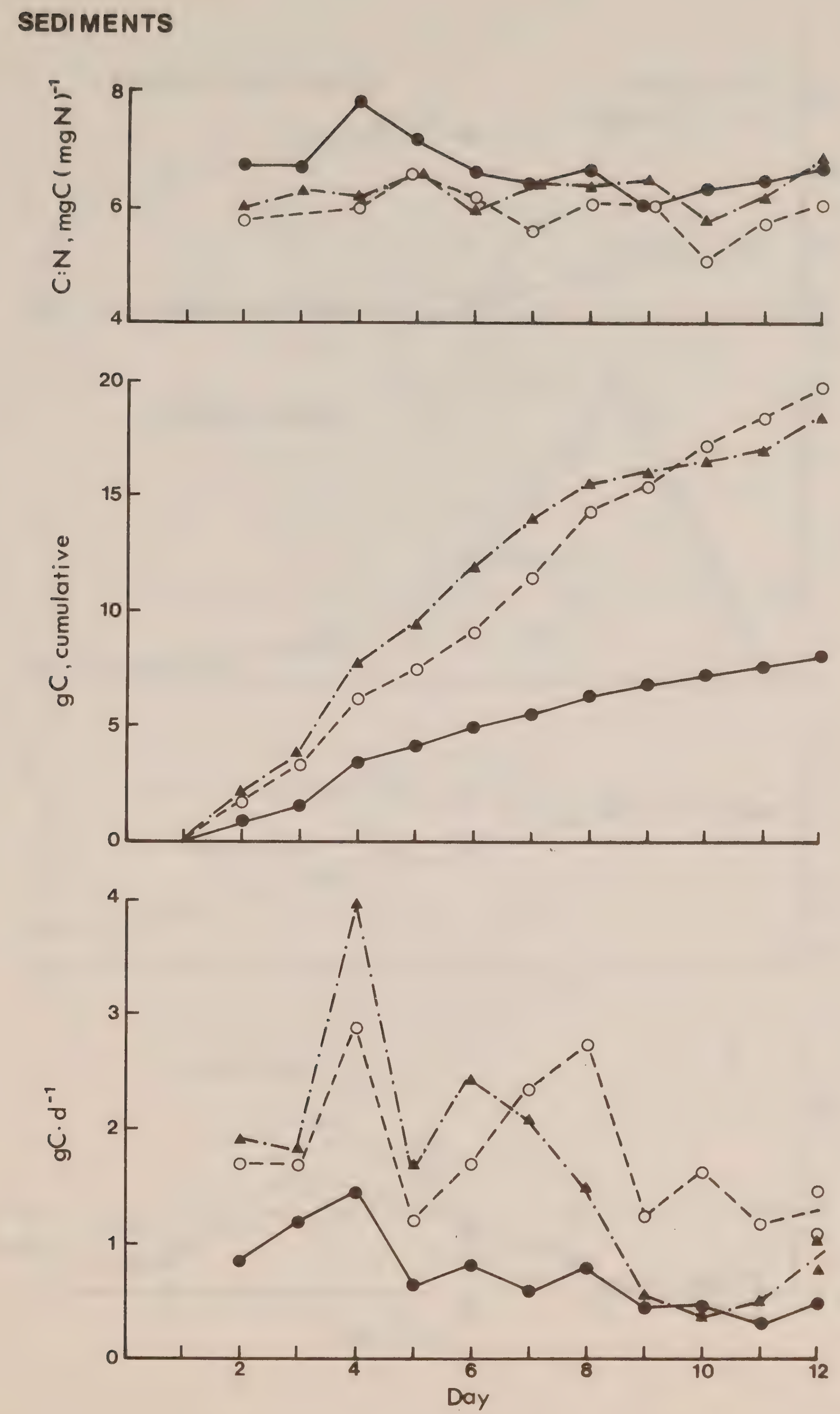
2500
0
1
3
5
8
10
12
Day

ZOOPLANKTON (0-13 m)

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C:N, mgC (mgN)$^{-1}$
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4
20
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3
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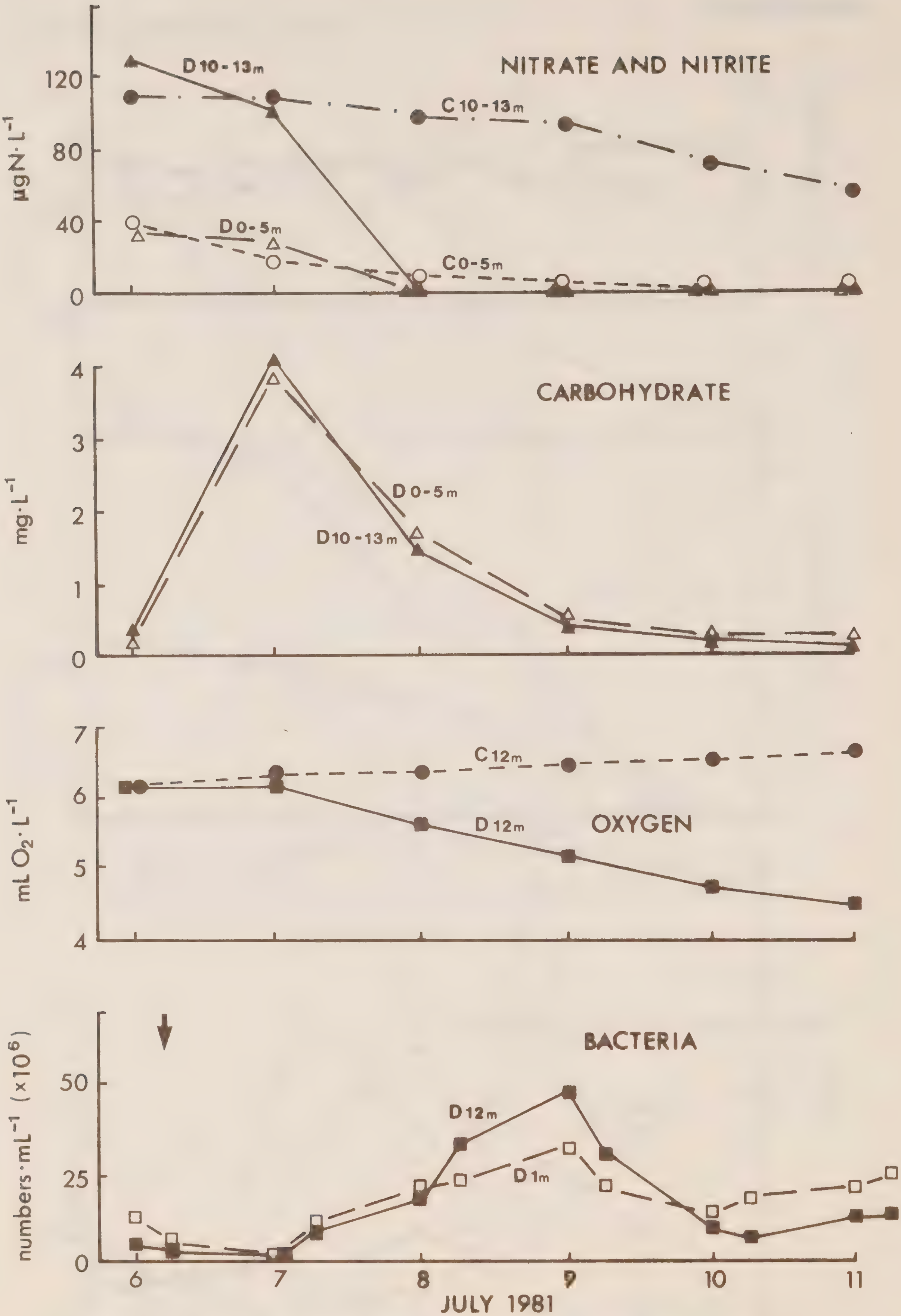
1
0
gC·d^{-1}
2
4
6
8
10
12
Day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80
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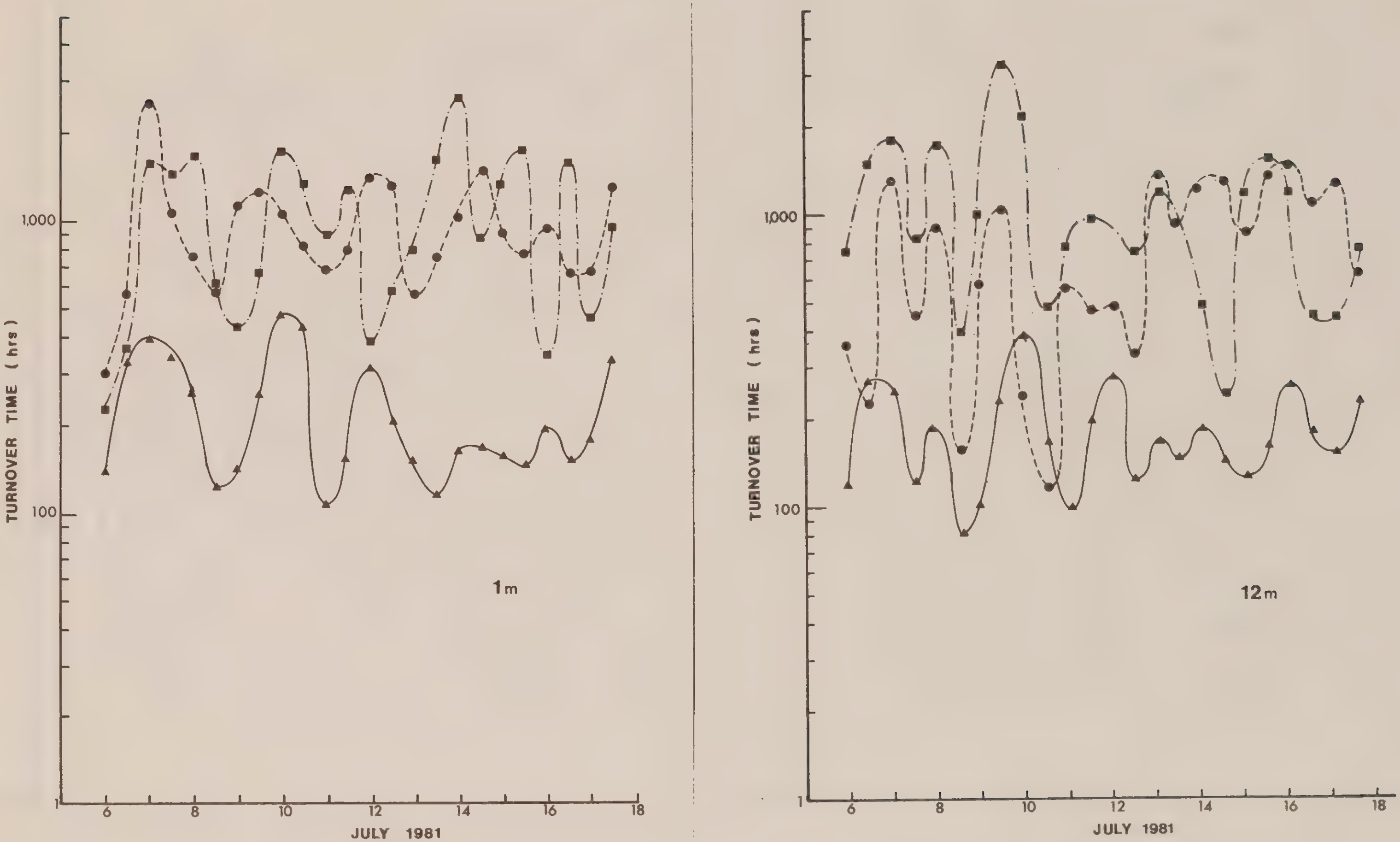
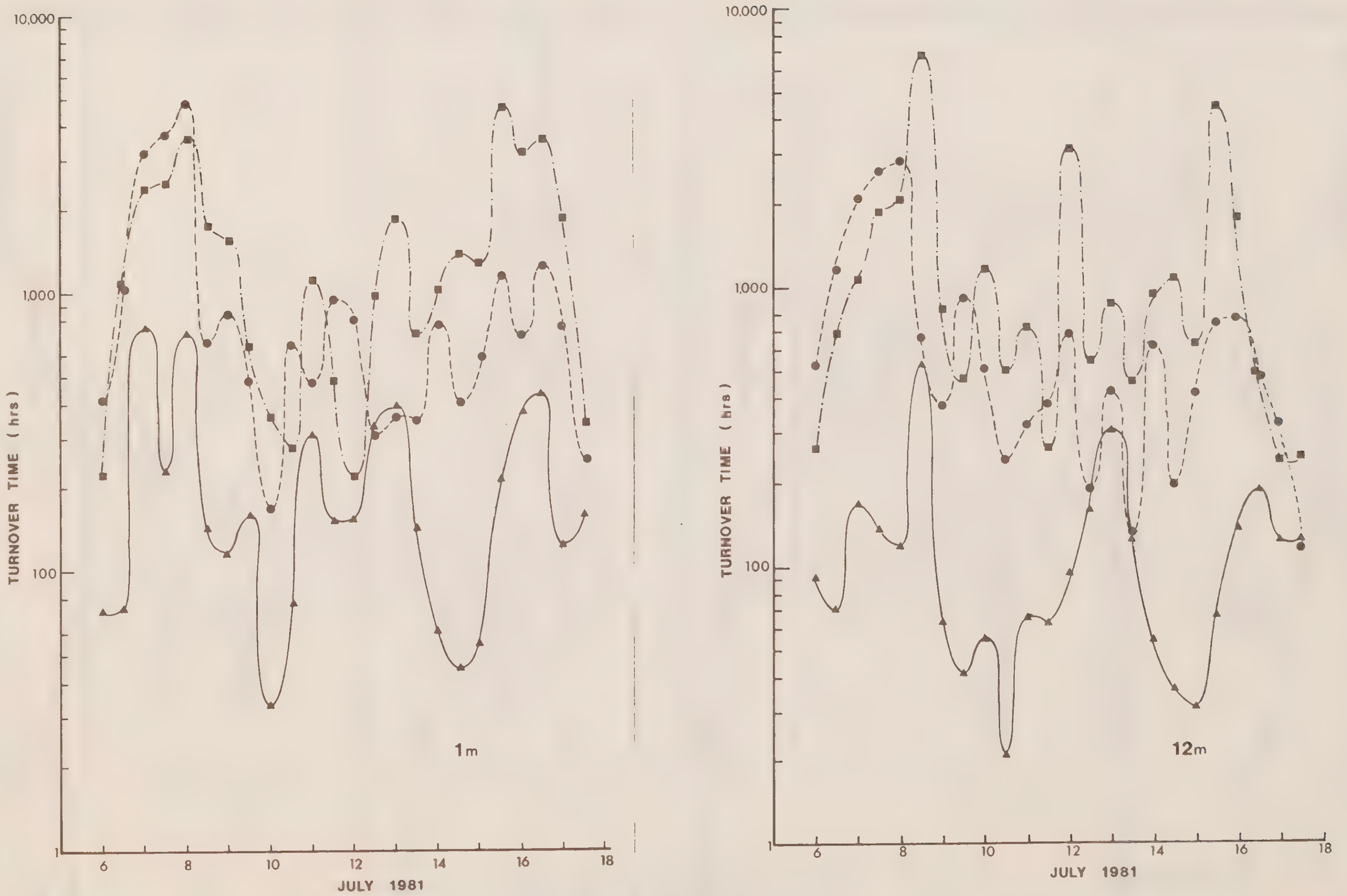
0
D 10-13m
C 10-13m
D 0-5m
C 0-5m
CARBOHYDRATE
mg·L⁻¹
4
3
2
1
0
D 0-5m
D 10-13m
OXYGEN
mL O2·L⁻¹
7
6
5
4
C 12m
D 12m
BACTERIA
numbers·mL⁻¹ (×10⁶)
50
25
0
D 12m
D 1m
6
7
8
9
10
11
JULY 1981

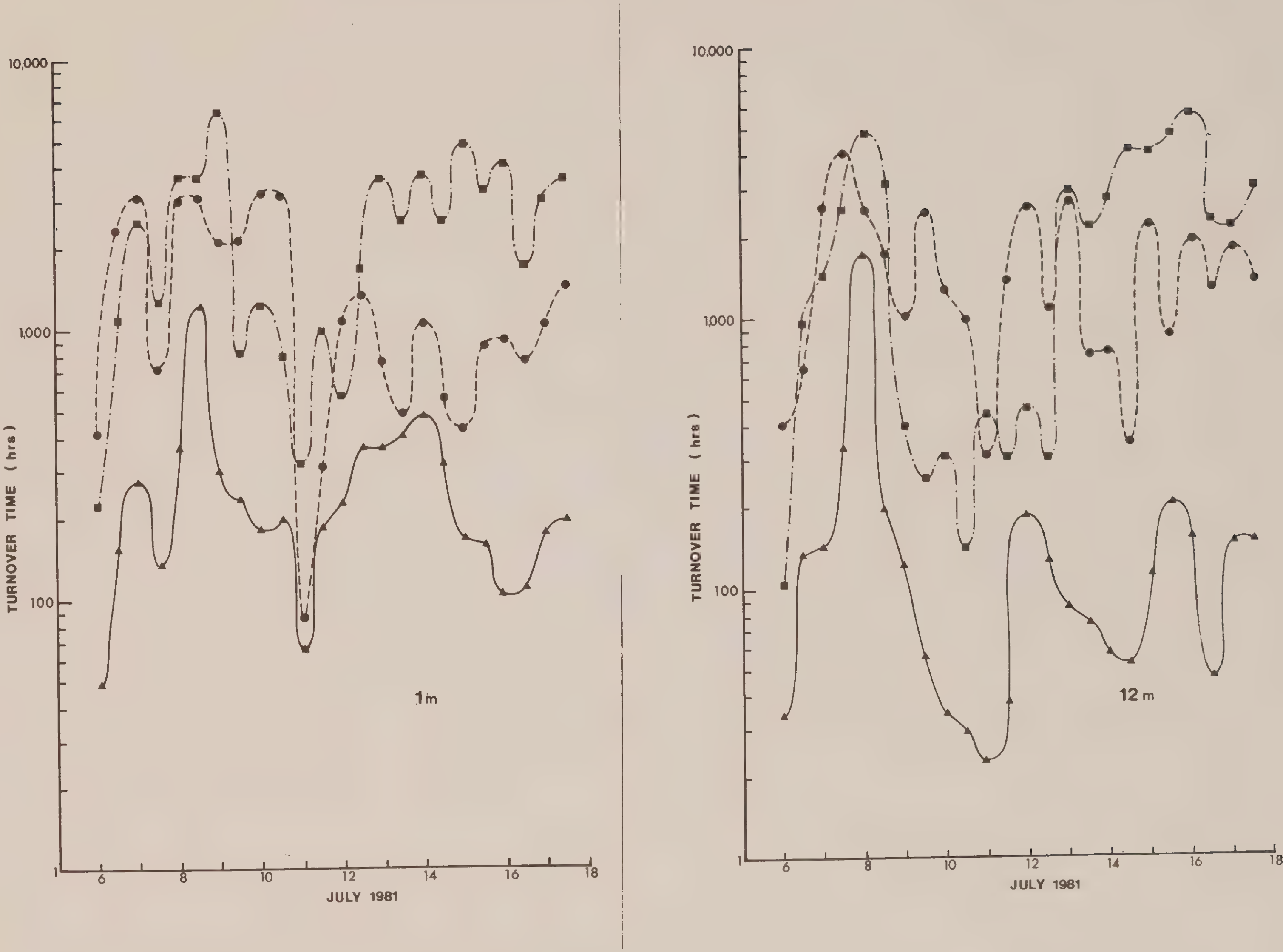
Turnover Rates of Organic Substrates Control



Turnover Rates of Organic Substrates Cu bag



Turnover Rates of Organic Substrates Cu+DOC bag



Pacific Marine Science Report 81-22

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and

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Pacific Marine Science Report 81-22

TIDAL CURRENTS IN JOHNSTONE STRAIT

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Institute of Ocean Sciences

Sidney, B.C.

1981

ABSTRACT

This report describes the tidal streams in the area of Johnstone Strait in British Columbia. Over a period of several years short-term current meter records were taken at 7 stations along the length of the Strait and at 2 stations in Queen Charlotte Strait. It was found that, although tidal streams at locations where observations had been made were predictable, interpolation between stations is difficult due to the complexity of the currents. Generally the tidal streams in Johnstone Strait are semi-diurnal, with the streams at depth stronger than the surface streams and the times of turns earlier. In the passes at the western end of the strait, times of slack water are best referenced to slack water times at Seymour Narrows.

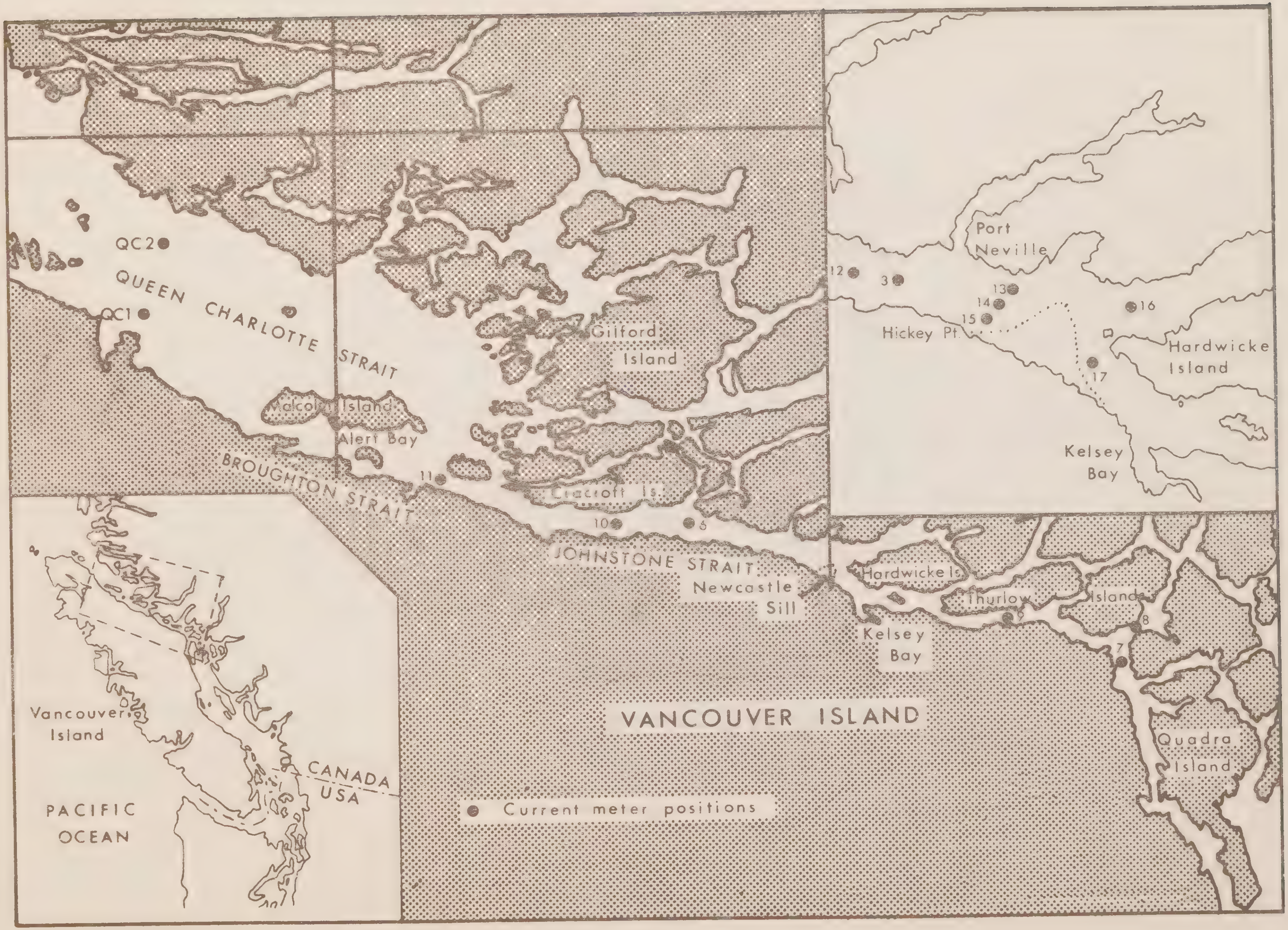

Figure 1. Current meter positions.

Introduction

The purpose of this publication is to bring to the notice of ship and tug masters, fishermen and other seafarers, the vagaries of the tidal streams in Johnstone Strait. It is hoped that after reading this publication they will be able to make better use of the tidal streams in their work, and realize the difficulty of trying to present to the mariner predictions of times and speeds of the currents in Johnstone Strait and the adjoining passes.

These measurements in Johnstone Strait were taken in the years 1976, 1977 and 1978 to gain some knowledge of the propagation of the tidal wave and streams along the Strait, and to investigate the internal tide that is present in the area of Hickey Point. This latter investigation is a direct outcome from the data taken in 1973. Continuous current meter records were taken at seven stations along the length of the Strait and two in Queen Charlotte Strait, with continuous temperature and conductivity records also taken at most locations. During the course of these surveys ten oceanographic cruises were carried out with CTD (conductivity, temperature, depth) measurements taken at thirty stations stretching from south of Cape Mudge in the Strait of Georgia to Gordon and Goletas Channels in Queen Charlotte Strait. These measurements are necessary to determine the density structure of the water, to enable prediction of the baroclinic streams. At twenty of these stations dissolved oxygen, silicate, nitrate and phosphate samples were taken. Bottom grab samples were also taken along the Strait from Yorke Island west to Hanson Island. The above data is recorded in Data Record of Current Observations Volumes VII and VIII.

Observations

The tidal streams in Johnstone Strait are predominantly semi-diurnal with a ratio of $\frac{K_1+O_1}{M_2+S_2} = 0.22$ in contrast to the tidal components which have a ratio of 0.58. The actual amplitudes of M_2 and K_1 at Station 3, for example, are 28.0 cm/sec and 6.5 cm/sec respectively. Owing to their strong semi-diurnal characteristic the tidal streams follow very closely that of the M_2 tide. Actual comparisons of the surface currents between Station 3 (Johnstone Strait Central) and other stations (Fig. 2) show that the time of the maximum current is practically the same as that for the M_2 stream (29.98° = 1 hour), and the standard deviation of the comparisons is less than 25 minutes at all stations. The time of maximum surface streams (15 m depth) is delayed by 2h 36m from the outer Station QC2 off Masterman Island to Station 7 in Discovery Passage, and the bottom streams lag by 3h 10m (Fig. 3). Although the bottom streams lag the surface streams at both ends of the Strait, 52 min at Masterman Island and 18 min at Station 7, at Station 3 the bottom stream leads the surface stream by 16 min. Also at Station 3, the amplitudes of the diurnal and semi-diurnal constituents for the tidal streams at 225 metres depth are much larger than those of the surface streams, being a factor of 2.5 and 1.7 respectively higher (Fig. 4 & 6). These strong streams at depth are due to a baroclinic current generated by the tide at the sill just east of Station 3. The sill disturbs the equilibrium level of the uniform density surfaces to create temporary unbalanced horizontal density gradients and hence internal tidal motions (Thomson 1976, Thomson and Huggett 1980).

The times of slack water (on the surface and at the bottom) vary quite remarkably from station to station and from day to day because of (a) the large residual current present, and (b) the weather conditions. The winds in Johnstone Strait either advance or retard the surface current, which affects the times of slack water. A section across Johnstone Strait at Station 3 shows the distribution of the residual current (Fig. 8). At a mean depth of approximately 115 m there is no residual current; above this depth the current is outgoing and below this depth it is incoming. This general pattern is typical of tidal estuaries, and holds good for the remainder of Johnstone Strait as shown by Figure 9, except that the mean depth for no residual current is about 75 m when east of Kelsey Bay.

The surface current in Johnstone Strait between York Island and Alert Bay is quite straightforward with the turn to flood and maximum rates at Station 10 being 10 minutes earlier than Johnstone Strait Central, and with the turn to ebb occurring at the same time. This stretch is characterized by the two ebb currents per day having nearly the same amplitude of 75 cm/sec, and where, after the slack, the current quickly rises to 75% of the maximum current or better and maintains this speed for 3½ hours or more. This relationship however, does not hold when the tides are predominantly diurnal, in which case a marked difference between the two ebb currents is evident (Fig. 10). The larger tidal range produces the larger tidal current, which varies anywhere between 20 and 40 cm/sec, and on the smaller tide range of the day the current varies between 5 and 15 cm/sec. The flood current following the lower low water (LLW) of the day is the larger of the two flood currents and is about twice that of the other flood current, and when the lower high water (LHW) is less than 3.8 m (12.5 ft) there will be no flood current.

The bottom currents along this stretch have, conversely, a large flood bias, but, unlike the surface where the ebb currents have the same speed for both daily currents, a large diurnal inequality exists with a maximum difference of 40 cm/sec. The larger flood currents (85-110 cm/sec) have a duration of 8½ hours, but the smaller flood currents maintain their maximum speed for 2½ hours to 3 hours. The larger ebb currents (50-70 cm/sec) have an average duration of 5 hours with the diurnal inequality only half (20 cm/sec) that of the flood currents.

In the passes at the western end of the Strait, the times of maximum current are the same, or nearly so, as Johnstone Strait Central, but the times of slack water differ considerably and are best referenced to slack water times at Seymour Narrows. In Blackney Passage and Broughton Strait where the surface currents are affected by the bottom currents, the times of slack water in these narrow, shallow passes are a compromise between the two slack waters. This results in the times of slack water on the turn to flood and ebb being respectively two hours earlier and one hour later than the surface slacks in Johnstone Strait. The slack waters at Blackney Passage are 30 minutes earlier than off Alert Bay, but 20 minutes later than Pulteney Point. In the area between Blinkhorn Light and Alert Bay there are strong tide rips present on the flood current. At the eastern end in Sunderland Channel the current is only half that of Johnstone Strait Central, and both slack waters and the maximum ebb occur 1 hour 40 min earlier, and the maximum flood 1 hour 10 min earlier than in Johnstone Strait. During the times of maximum flood and ebb there are strong tide rips or fronts

present in the channel between Kelsey Bay and Port Neville.

In Johnstone Strait east of Yorke Island the times of maximum flood and ebb currents on the surface occur about 20 minutes later than those to the west of Yorke Island, but the times of slack water differ widely. Again the ebb bias is very prominent, and both daily ebb currents have the same velocity of 120 cm/sec. This appears to be the maximum velocity attained in that part of the channel, and the current maintains this speed for 2½-3 hours. When the range of the tide is less than 1 m, the maximum ebb velocity drops to about 70 cm/sec with some diurnal inequality in the two daily ebb currents. The flood currents, on the other hand, have a large diurnal inequality with the speed of the flood current following LLW being double that of the other flood current. The maximum floods have velocities up to 110 cm/sec, but when the range of the tide is less than 1 m, there is no flood current for that period. The maximum flood currents here and the maximum ebb currents west of Yorke Island are both dependent on the range of the tide as evidenced by the graphs in Figures 12-17. An appreciation of the current velocity to be expected from the range of the tide at Alert Bay can be had from these graphs.

The times of slack water are vastly different from those of Johnstone Strait Central, the turn to flood occurring 35 minutes earlier and the turn to ebb 90 minutes later. In Race Passage however the currents are the same as Johnstone Strait Central, but in Current Passage the turn to ebb occurs about 75 minutes earlier than the turn to ebb in Race Passage.

The bottom current along this part of the Strait east of Yorke Island also has a large flood bias with the flood current having a maximum speed of 120 cm/sec, but unlike the surface current, does vary with the tidal range. The maximum flood current also has two peaks roughly 2½ hours apart with a 20-40 cm/sec drop in speed between the two peaks (Fig. 11). This phenomenon was not apparent at any of the other stations in Johnstone Strait. The difference between the two daily flood currents is 30 cm/sec at times, the duration of the flood current is around 8½ hours and for at least half of the time the current is running at 80% or better of the maximum speed. The ebb current is generally less than 45 cm/sec, but when the tides are predominantly diurnal, rates up to 60 cm/sec are present. The duration of the ebb current is about 4 hours, with the diurnal inequality greater than that of the flood stream, attaining a difference of 50 cm/sec at times.

In Nodales Channel the bottom currents are more diurnal than at Station 9. The velocity of the bottom water entering and leaving Nodales Channel is only one-third of that at Station 9 (40 cm/sec as opposed to 120 cm/sec), and the times of maximum current vary anywhere from a half hour to five hours earlier. When the tidal range is large the current continues to flood (north going) on the bottom in Nodales Channel on the largest ebb of the day (a continuation of the ebb in Discovery Passage).

In Race and Current Passages, situated between Kelsey Bay and Station 9, the times of maximum flood and ebb are at the same time as those at Station 9, and the times of slack turn to flood are 15 minutes earlier than Station 9. The turn to ebb in Current Passage occurs 45 minutes earlier, and in Race Passage it occurs 30 minutes later than at Station 9. At the

north end of Discovery Passage the maximum flood occurs 10 min later and the maximum ebb 30 minutes later than at Station 9, with the times of slack water being very close to those of Seymour Narrows.

Looking at the Strait in cross-section in the vicinity of Station 3 over a 25 hour period during a time of average tide heights, large differences from one side to the other are evident on the surface in the speeds and time of the turn (Fig. 18). The flood current starts at depths around 200 m and builds up to speeds greater than 40 cm/sec while there is still an ebb current running on the surface. On the surface the flood current starts along the Vancouver Island shore at about the same time as it starts at depth, but takes over 2 hours to completely cover the Strait from one side to the other, with the current along the Vancouver Island shore far stronger than elsewhere across the Strait. However, as soon as the flood current covers the entire Strait, the speed drops off dramatically to about one-third of its maximum speed. In less than 2 hours after the flood current covers the entire surface, the ebb current is starting to run along the mainland shore, and within the hour the whole Strait on the surface is ebbing. The flood current still continues to run at depth for about 2 hours after the start of the ebb on the surface. At the time of maximum ebb, the current speed is the same across the Strait, then falls off quickly on the Vancouver Island shore prior to the start of the next flood current. The ebb current runs the strongest on the surface with the speed decreasing with depth.

On a cross-section 5.5 km (3 miles) to the east of Station 3, the start of the flood current exhibits the same characteristics as it did further to the west, but the ebb current appears to start in the centre of the channel rather than along the mainland shore, and when running at its maximum is much stronger along the mainland shore. On a large flood as shown in Fig. 19, the flood current runs for 6 hours on the surface, longer at depth, and the change to ebb on the surface is much quicker, within the hour, than on the change to flood.

A longitudinal look at the Strait between Stations 12 and 17, and on the same day as the cross-section at Station 14 was plotted, shows that at Station 17 on the bottom the ebb current runs for a very short duration, something less than four hours (Fig. 20). A prominent feature is again the wedge of strong flood current between 200 and 150 metres depth that persists long after the ebb current is running on the surface, and even after it is ebbing on the bottom. Another feature is the magnitude of the flood current at Station 3 at 235 m depth where it is much greater than that at Station 12 or 14 at maximum flood.

Conclusions

Although the above features are regular in time, their complexity makes them difficult to describe and to present in one or two simple graphs. The tidal streams at any point can be predicted well, but their rapid change in behavior along the Strait, across the Strait, and with depth requires many reference and secondary stations in the tide tables, and defies simple explanations.

In 1982 current meter observations will be taken at Stubbs Island, east of Alert Bay, and from these observations it is hoped that better current predictions will result for the passes at the western end of Johnstone Strait.

Acknowledgements

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References

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Thomson, R.E. 1976. Tidal currents and estuarine-type circulation in Johnstone Strait, British Columbia, J. Fish. Res. Board, Canada, 33(10), p. 2242-2264.

____________. 1977. Currents in Johnstone Strait, British Columbia: supplemental data on the Vancouver Island side, J. Fish. Res. Board Canada, 34(5), p. 697-703.

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Glossary of Terms

Baroclinic current:	is that current induced by two layers of water of different density having a sloping interface.
Barotropic current:	is that current induced by a sloping sea surface.
cm/sec:	51.48 cm/sec = 1 knot
Diurnal:	having a period of, occurring in, or related to a day.
Diurnal inequality:	the difference between the heights of two successive high or low tides, or the difference in the speed between two successive flood or ebb tidal streams.
Front:	the vertical intersection of two masses of water of different density; often visible on the surface as tide lines or rips.
M_2:	the principal lunar semi-diurnal constituent; that variation of the tide or current having 2 cycles per day and due to the gravitational attraction of the moon.
K_1:	the principal diurnal constituent; that variation of the tide or current having 1 cycle per day and due to the combined gravitational attractions of the sun and moon.
Residual current:	non-tidal current due to causes other than tidal. It is that part of the total current that is left after the tidal component is removed.
Semi-diurnal:	having a period of, occurring in, or related to approximately half a day.
Tidal stream:	a current due to tidal action. Tidal stream + residual current = observed current.
Tidal wave:	a long period wave associated with the tide-producing forces of the moon and sun. Longest wave known in the ocean.

	Turn to Flood		Maximum Flood		Turn to Ebb		Maximum Ebb	
	h	m	h	m	h	m	h	m
Bear Point (J9)	-0	35	+0	30	+1	35	+0	20
Camp Point	-0	20	+0	30	+2	05	+0	20
Current Passage	-0	20	+0	30	+0	50	+0	20
Sunderland Channel (J16)	-1	40	-1	10	-1	40	-1	40
Forward Bay (J10)	-0	10	-0	10	0	00	-0	10
Masterman Island (Q02)	-3	45	-1	55	0	00	-1	55
Browning Islands (Q01)	-2	25	-1	50	-1	05	-1	55
Blackney Passage	-1	10*	0	00	-1	10*	0	00
Alert Bay	-0	40*	0	00	-0	40*	0	00
Pulteney Point	-1	30*	0	00	-1	30*	-1	00

* Time difference for "Turn to Flood" and "Turn to Ebb" to be applied to the predictions for Seymour Narrows.

Figure 2. Time differences between Johnstone Strait Central and secondary stations along Johnstone Strait for maximum currents and turns.

M2

	Masterman Island		Station #3		Station #9
Surface Currents	158^o	116min →	214^o	29min →	228^o
Tide (Yorke Is.)	21^o	39min →	40^o	68min →	73^o
Bottom Currents	135^o	178min →	221^o	6min →	224^o

K1

	Masterman Island		Station #3		Station #9
Surface Currents	224^o	176min →	268^o	-136min →	234^o
Tide (Yorke Is.)	130^o	40min →	140^o	40 min →	150^o
Bottom Currents	200^o	28min →	207^o	168min →	249^o

Figure 3. Diurnal and semi-diurnal times between Queen Charlotte Strait and Station 9, Johnstone Strait.

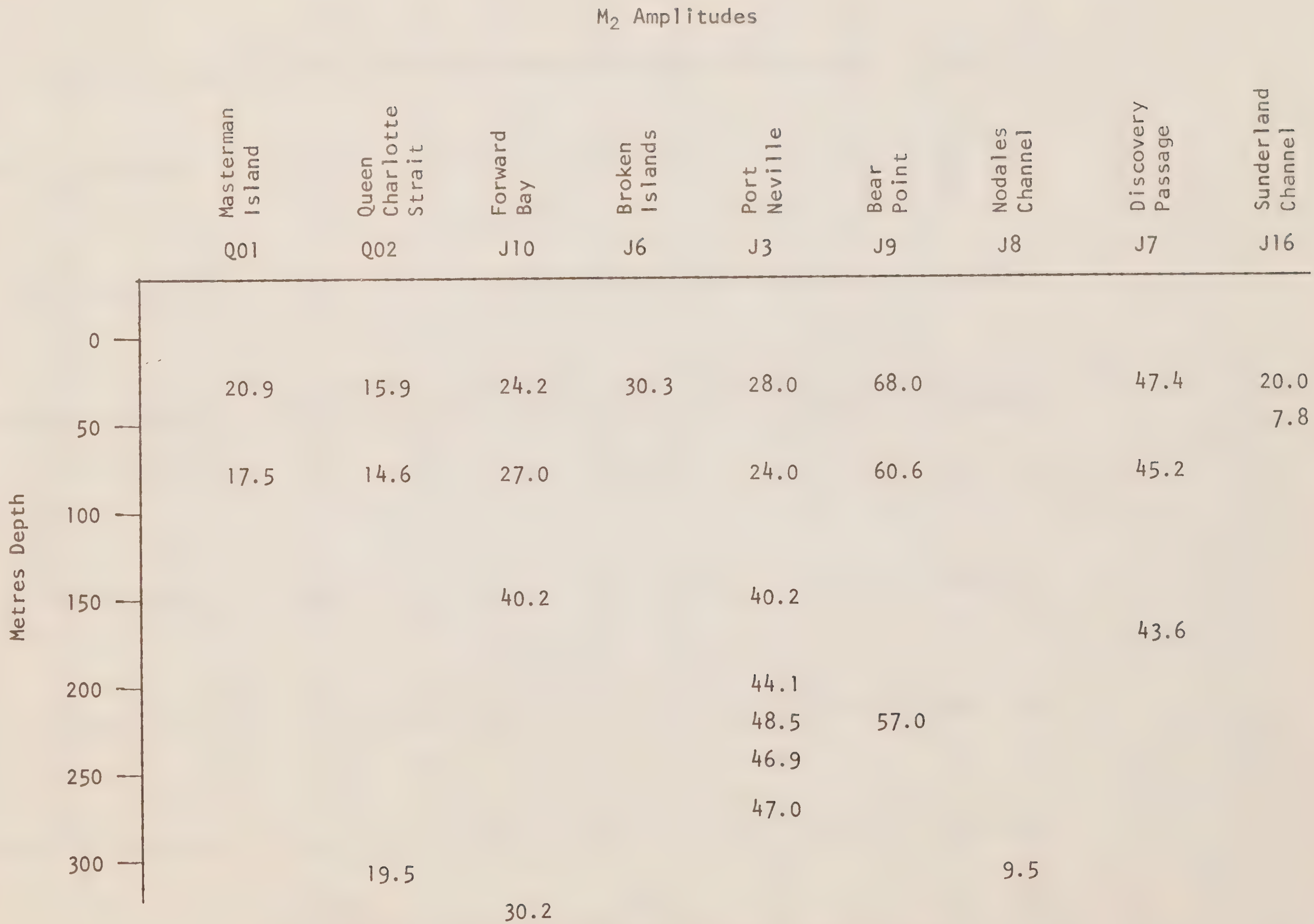


Figure 4. Semi-diurnal speeds of the tidal streams in cm/sec.

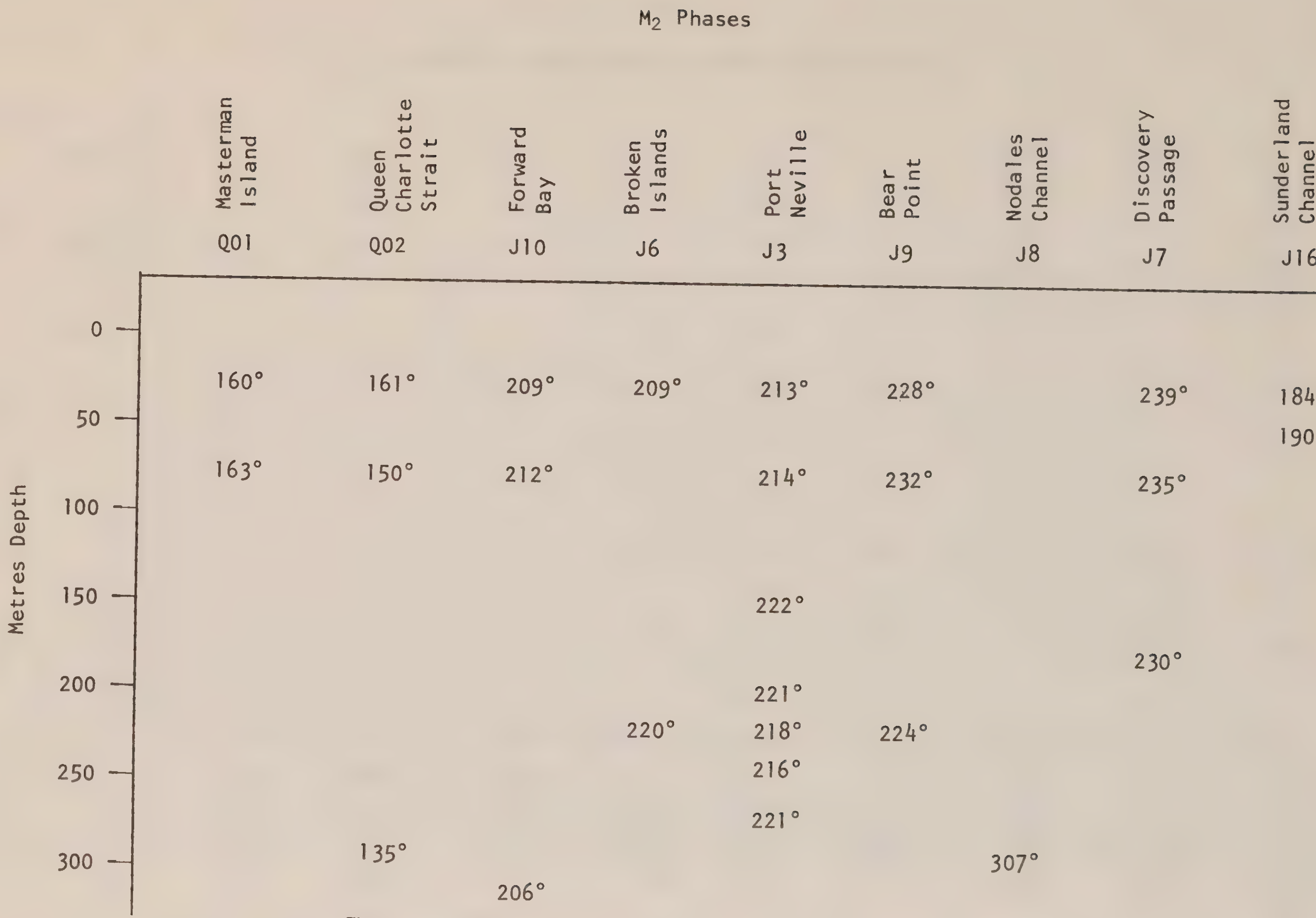


Figure 5. Phases of the semi–diurnal tidal streams. (28.98° = 1 hour)

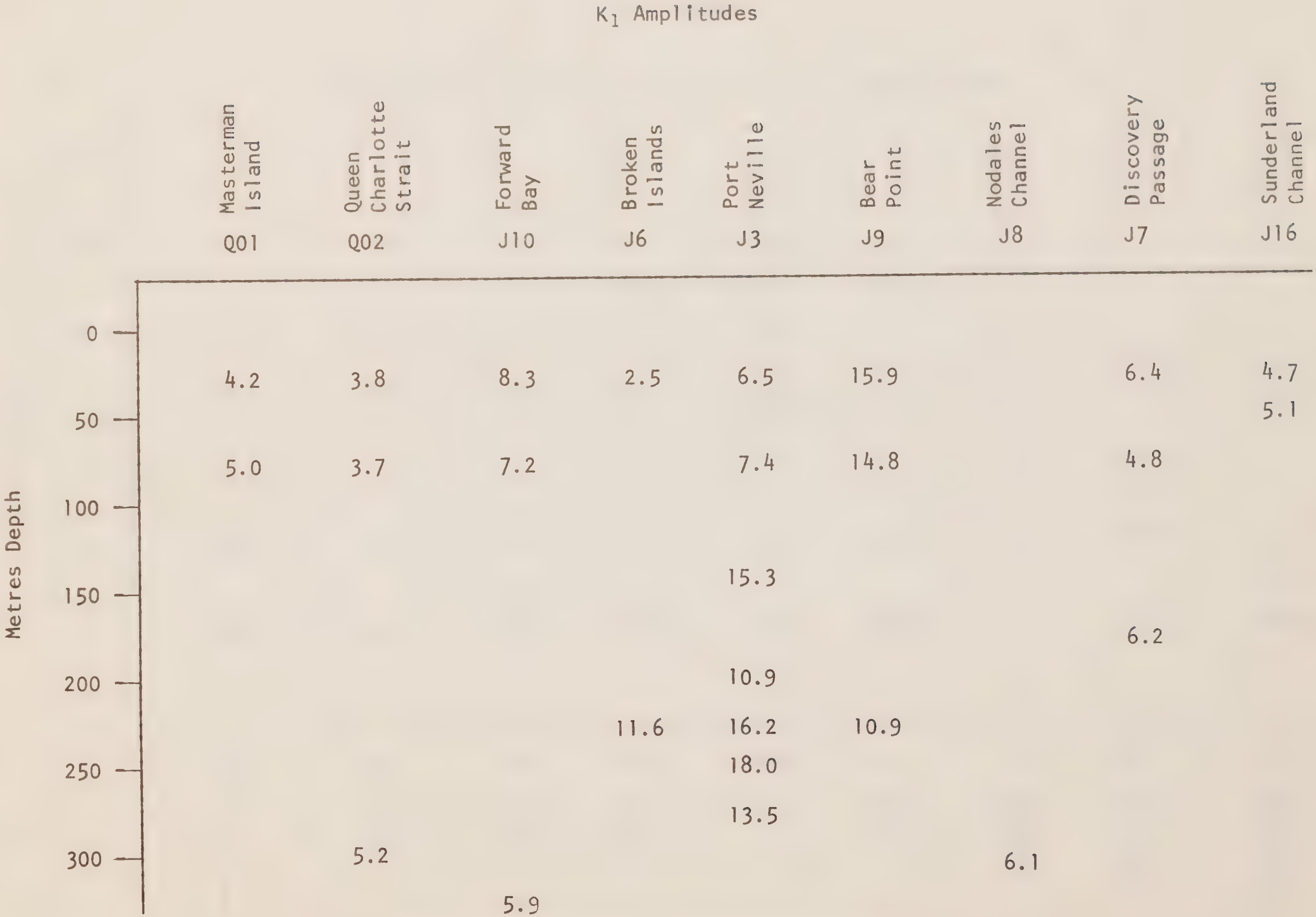


Figure 6. Diurnal speeds of the tidal streams in cm/sec.

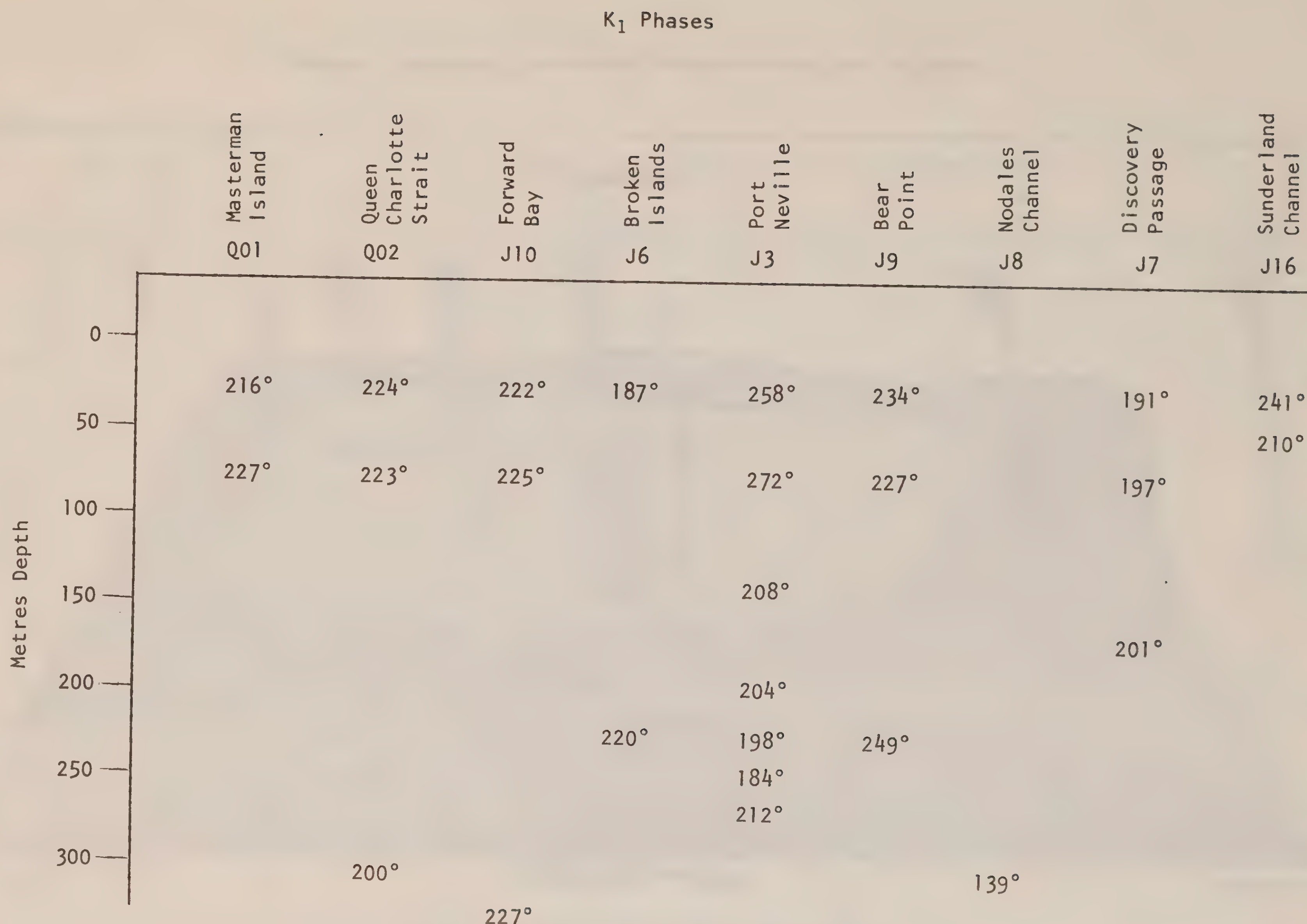


Figure 7. Phases of the diurnal tidal streams.) (15.04° = 1 hour)

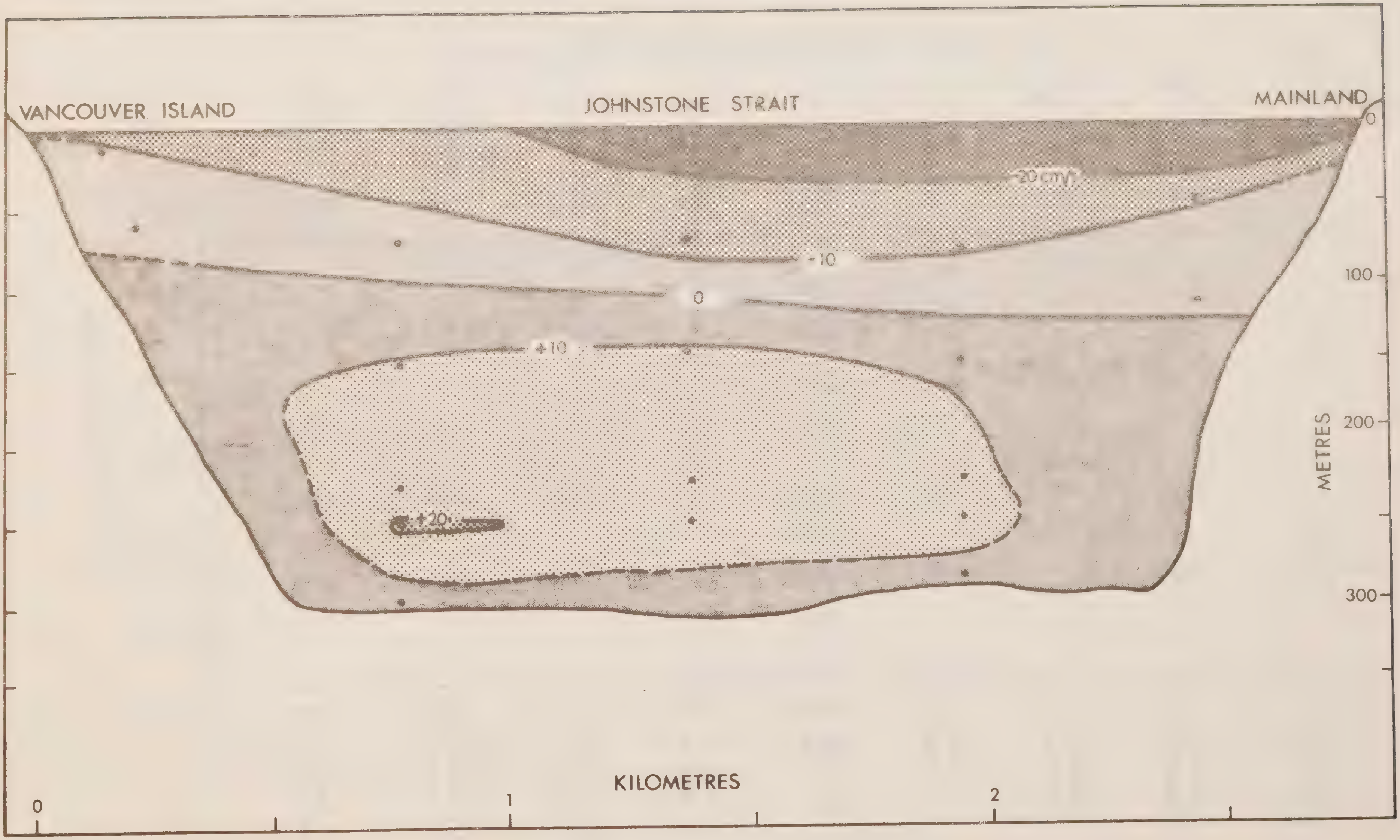


Figure 8. Distribution of the residual current across the Strait at Station 3.

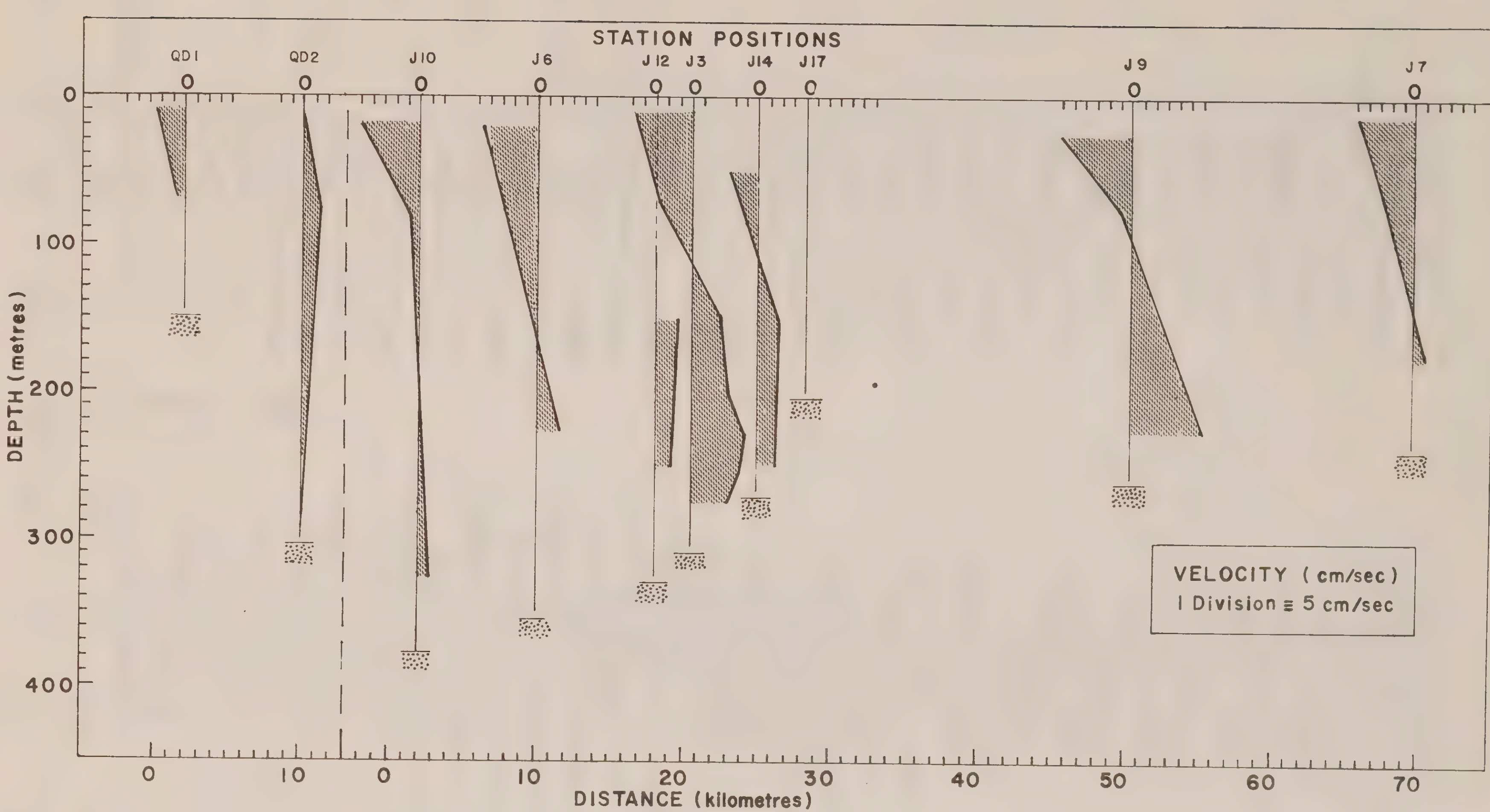


Figure 9. Distribution of the residual current along the Strait.

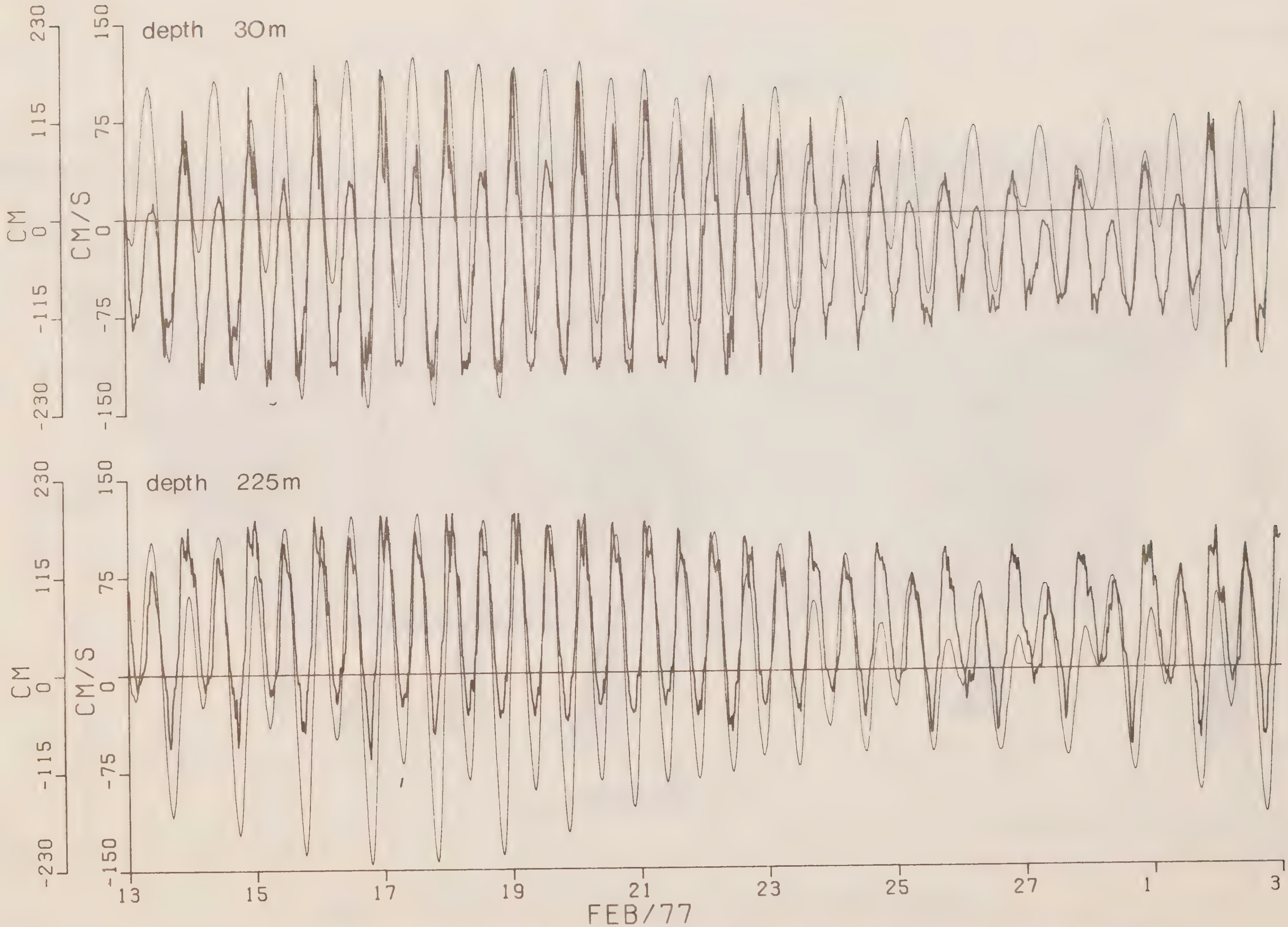


Figure 11. Plot of the surface and bottom currents at Station 9 with the tide (fine line) superimposed.

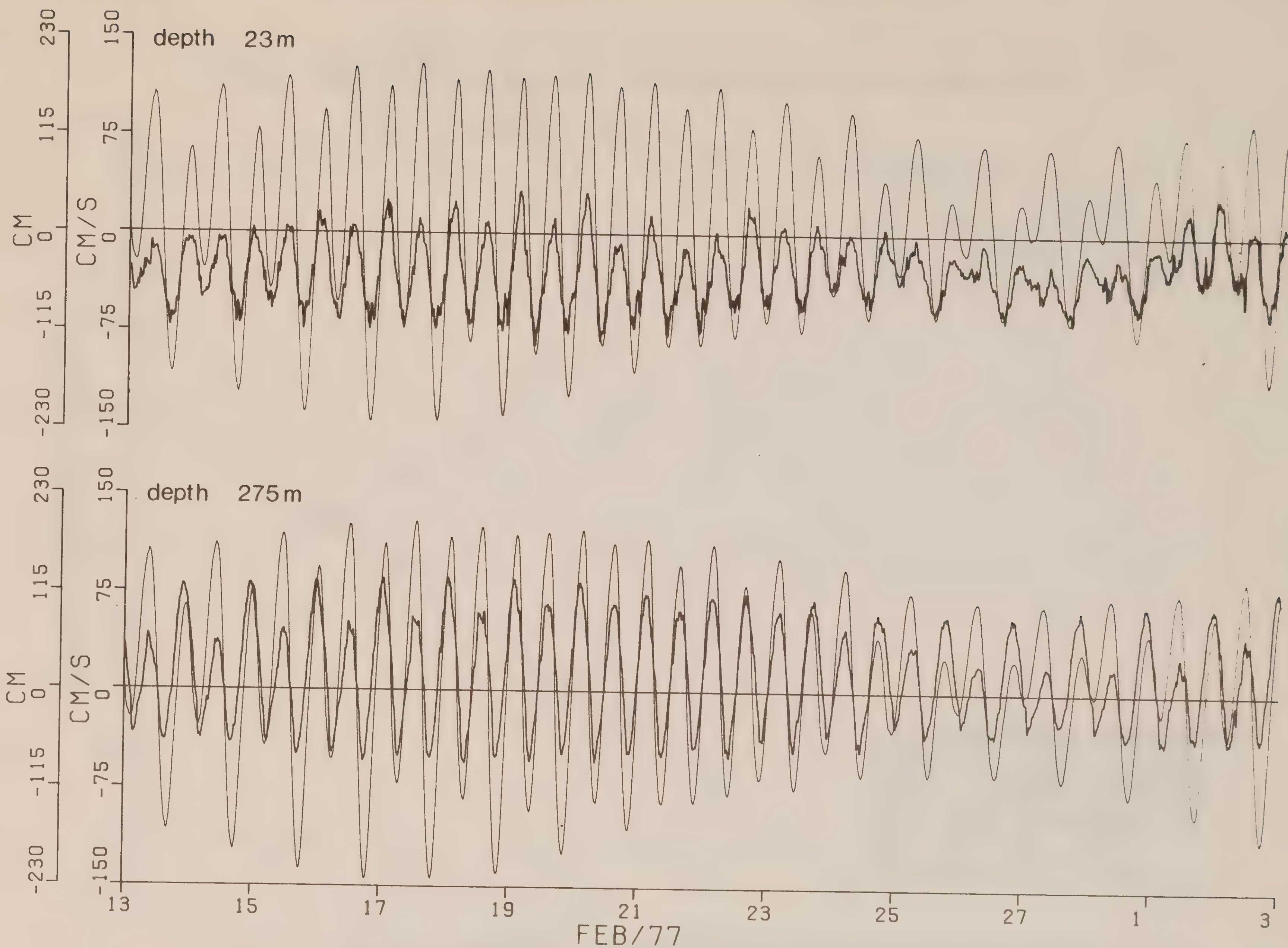


Figure 10. Plot of the surface and bottom currents at Station 3 with the tide (fine line) superimposed.

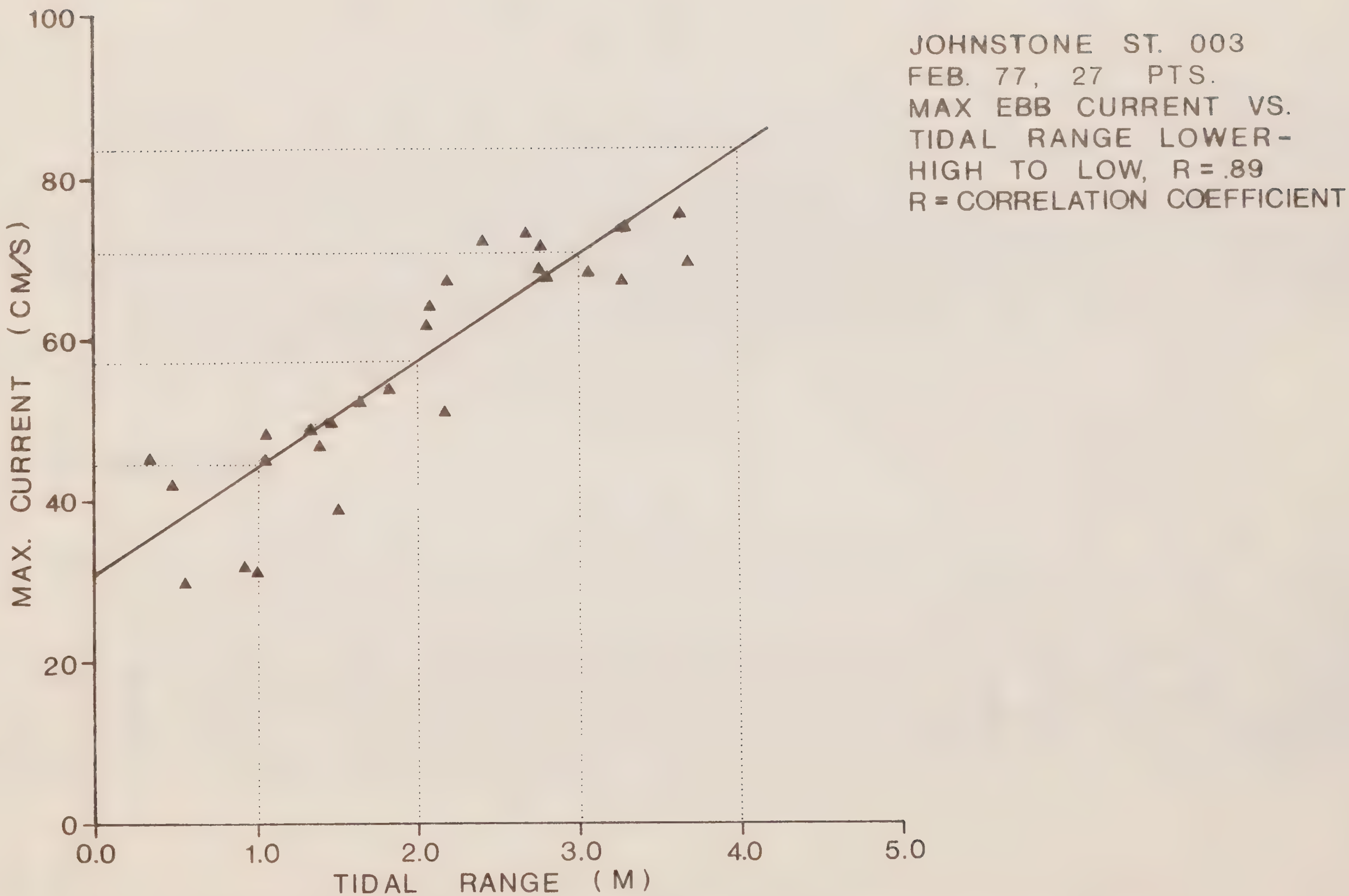


Figure 12. Station 3 Plot of maximum ebb current and the tidal range between lower high water and low water.

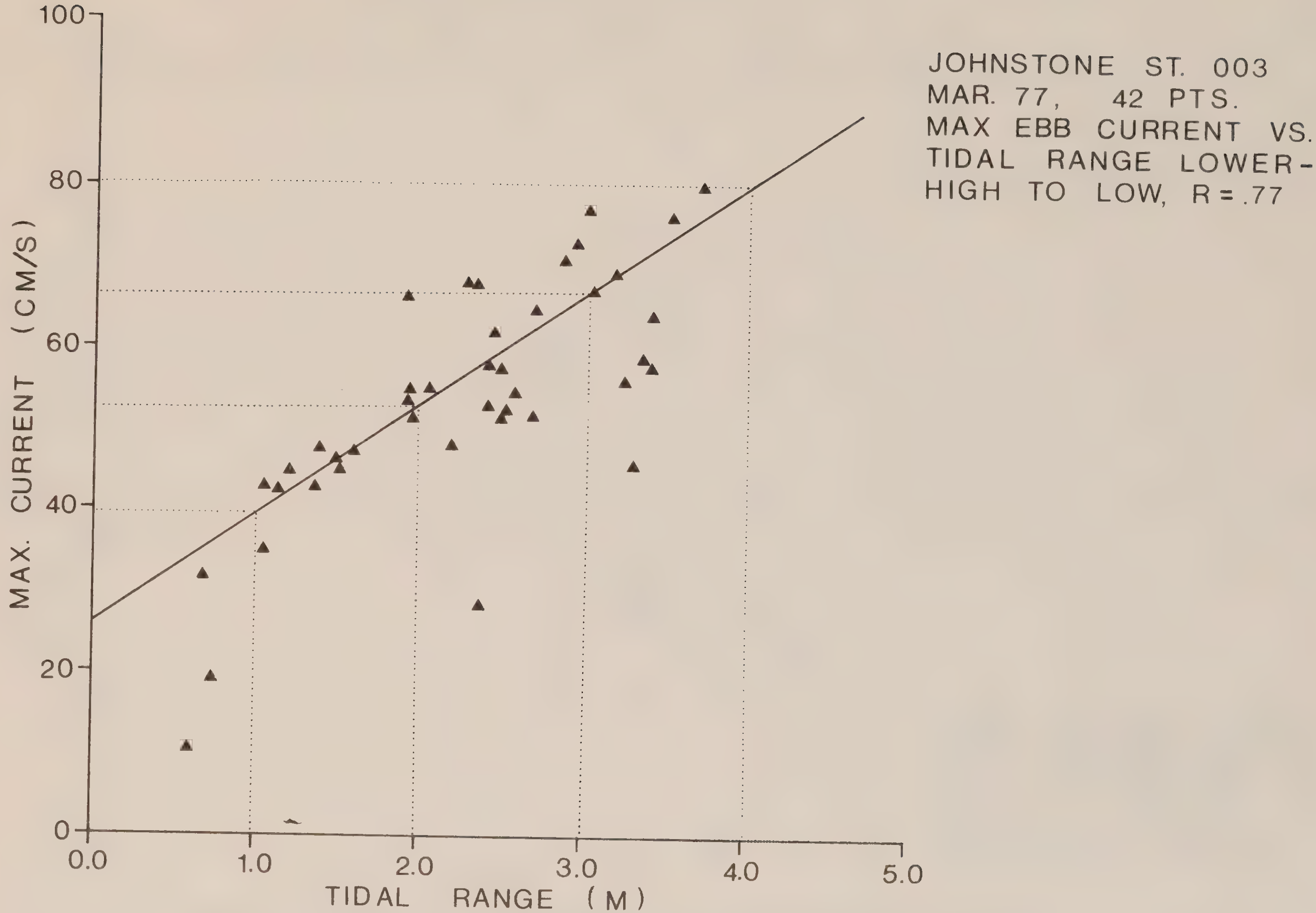


Figure 13. Station 3. Plot of maximum ebb current and the tidal range between lower high water and low water. Same as Figure 12. An indication of the current to be expected may be obtained from the above tidal range. See Figure 14.

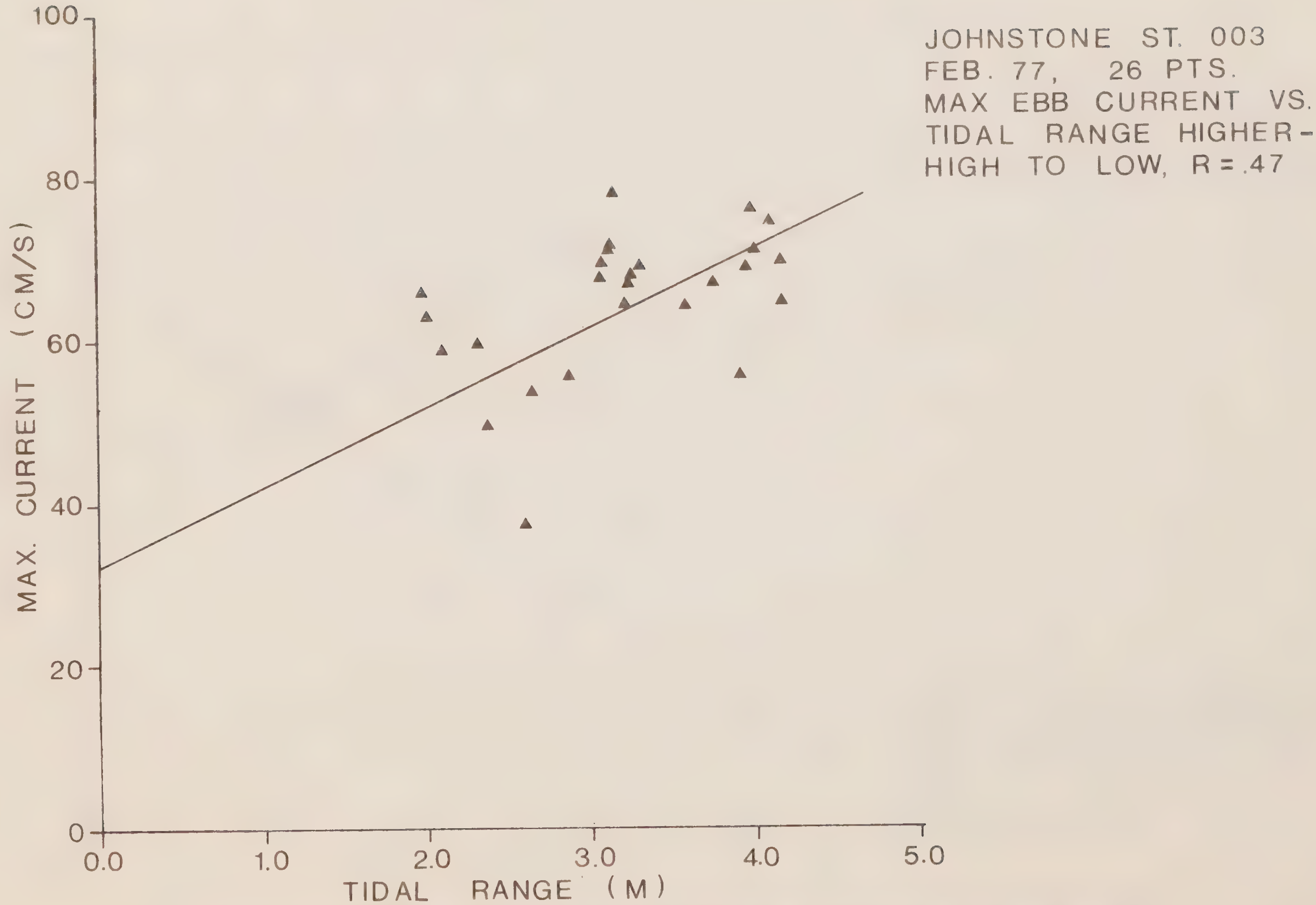


Figure 14. Station 3. Plot of maximum ebb current and the tidal range between higher high water and low water. This tidal range does not give a good indication of the currents to be expected.

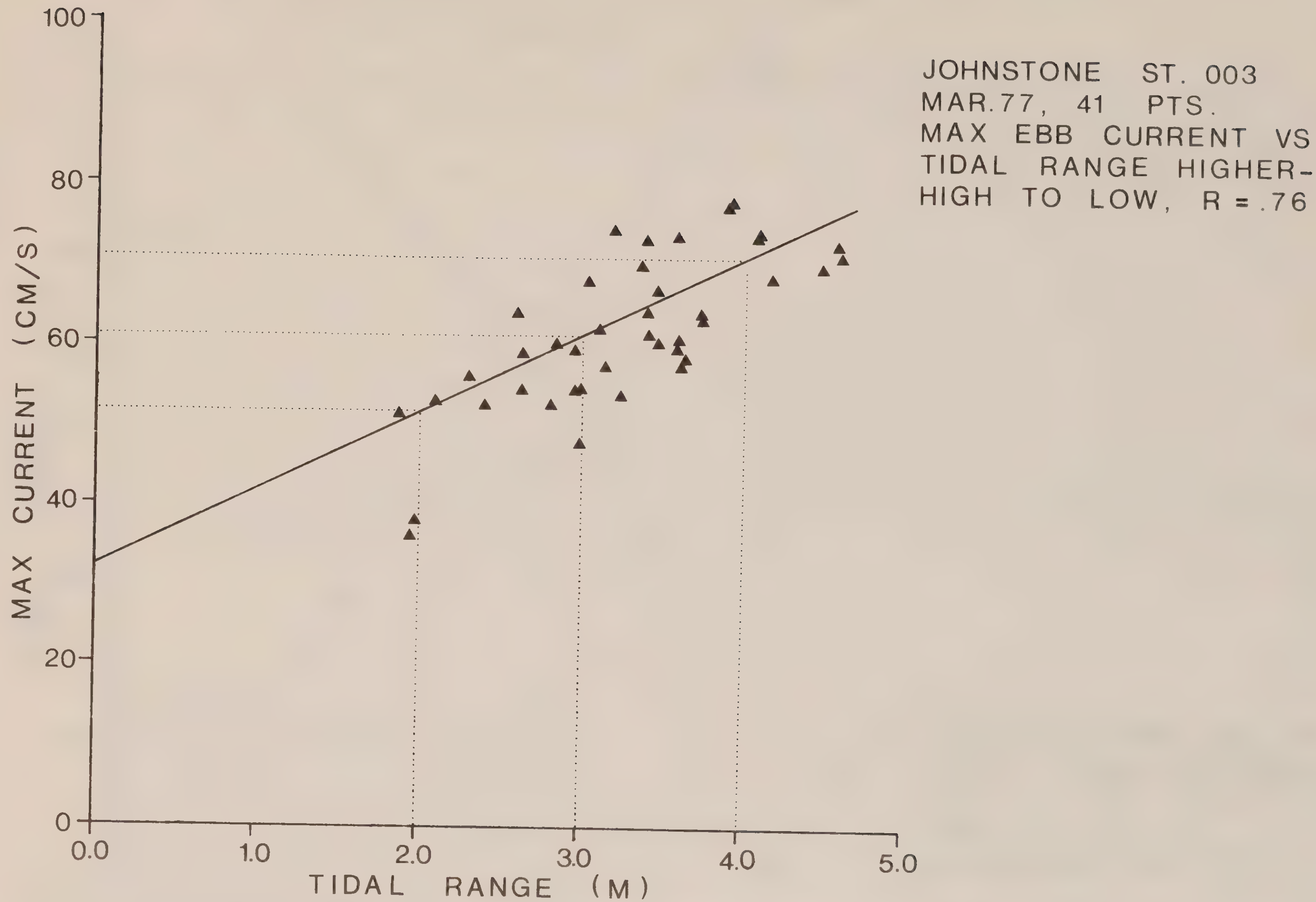


Figure 15. Station 3. Plot of maximum ebb current and the tidal range between higher high water and low water. This gives a very approximate indication of the currents to be expected.

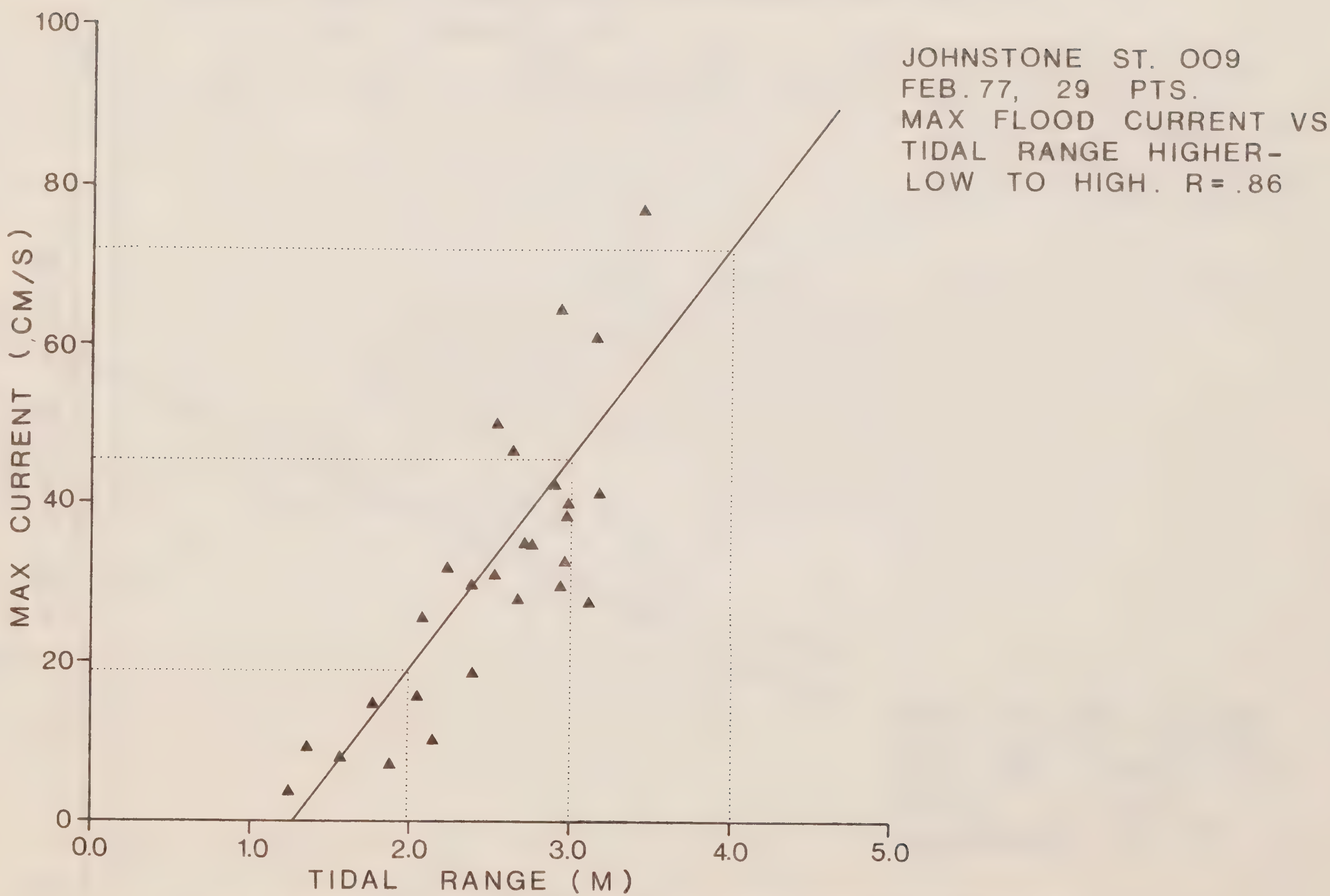


Figure 16. Station 9. Plot of maximum flood current and the tidal range between higher low water and high water.

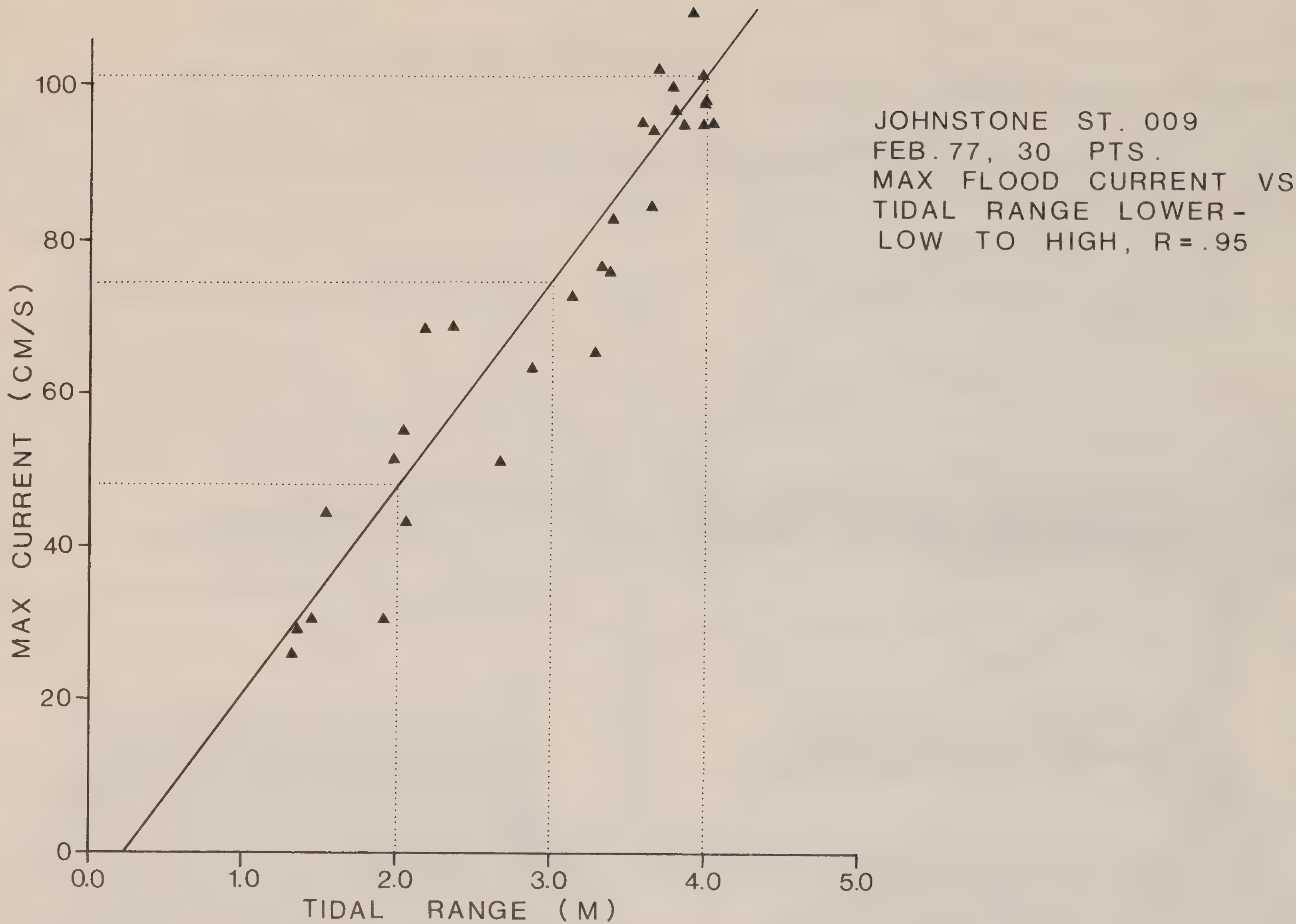
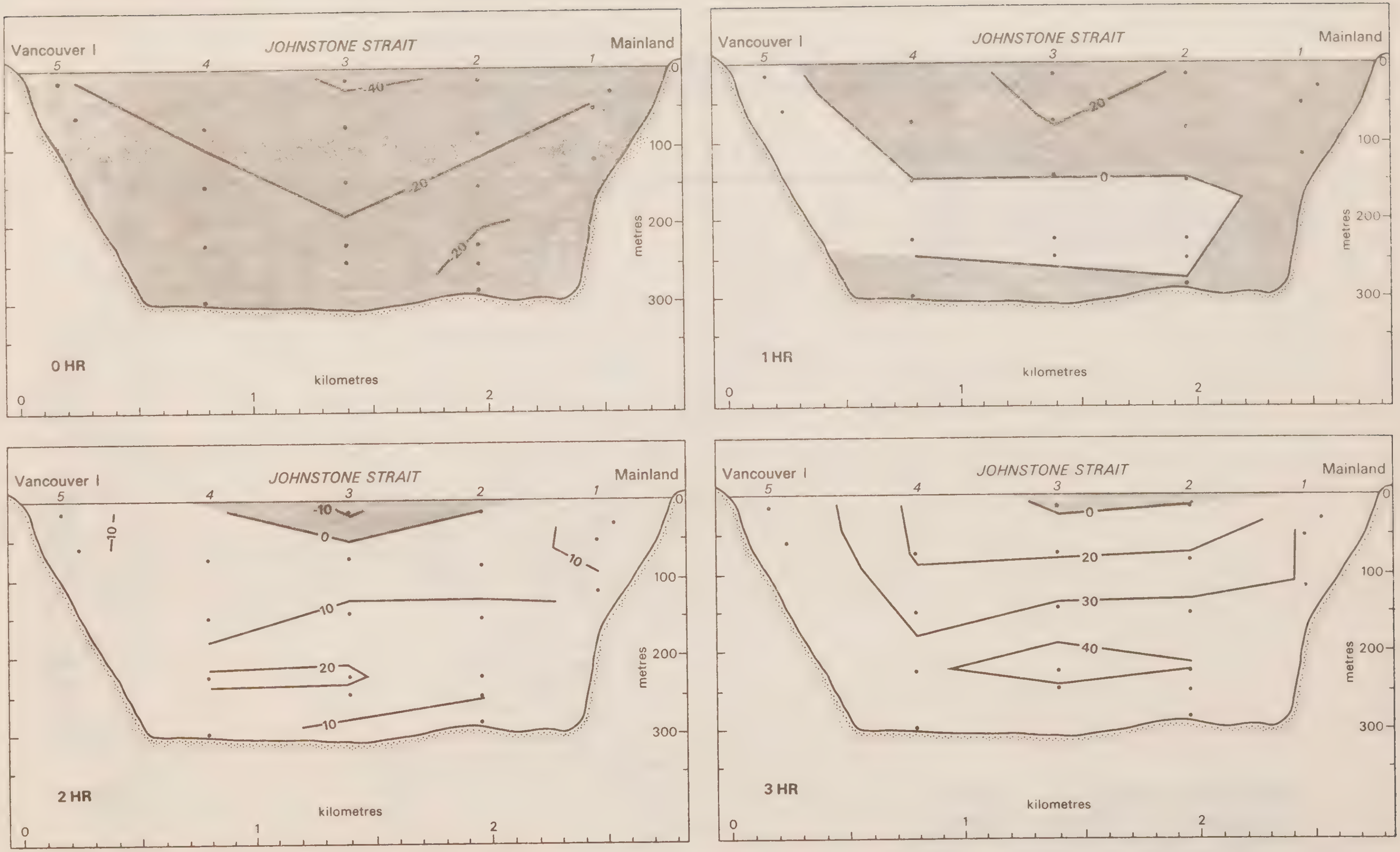
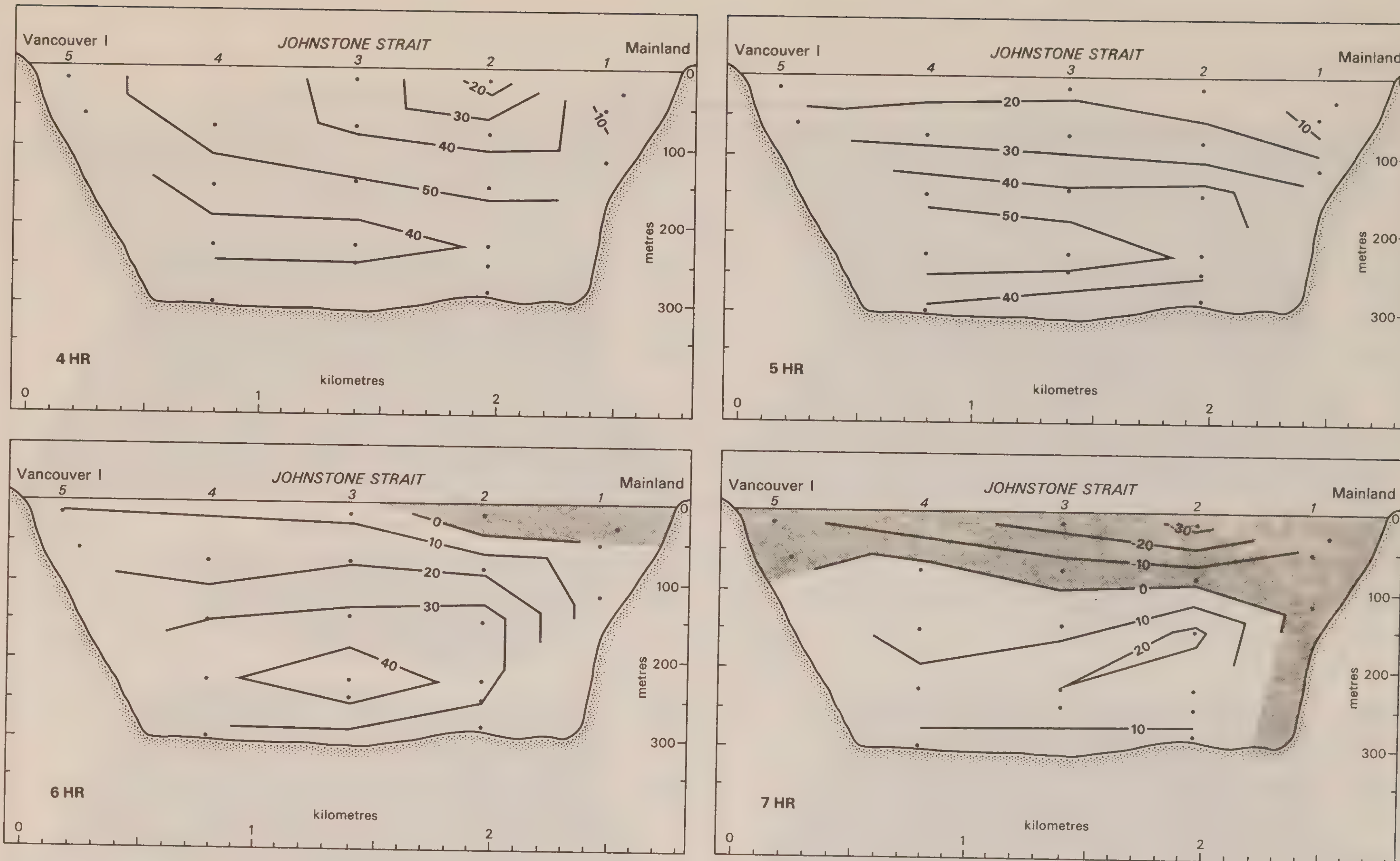


Figure 17. Station 9. Plot of maximum flood current and the tidal range between lower low water to high water. Figures 16 and 17 will give a fairly good indication of the currents to be expected.

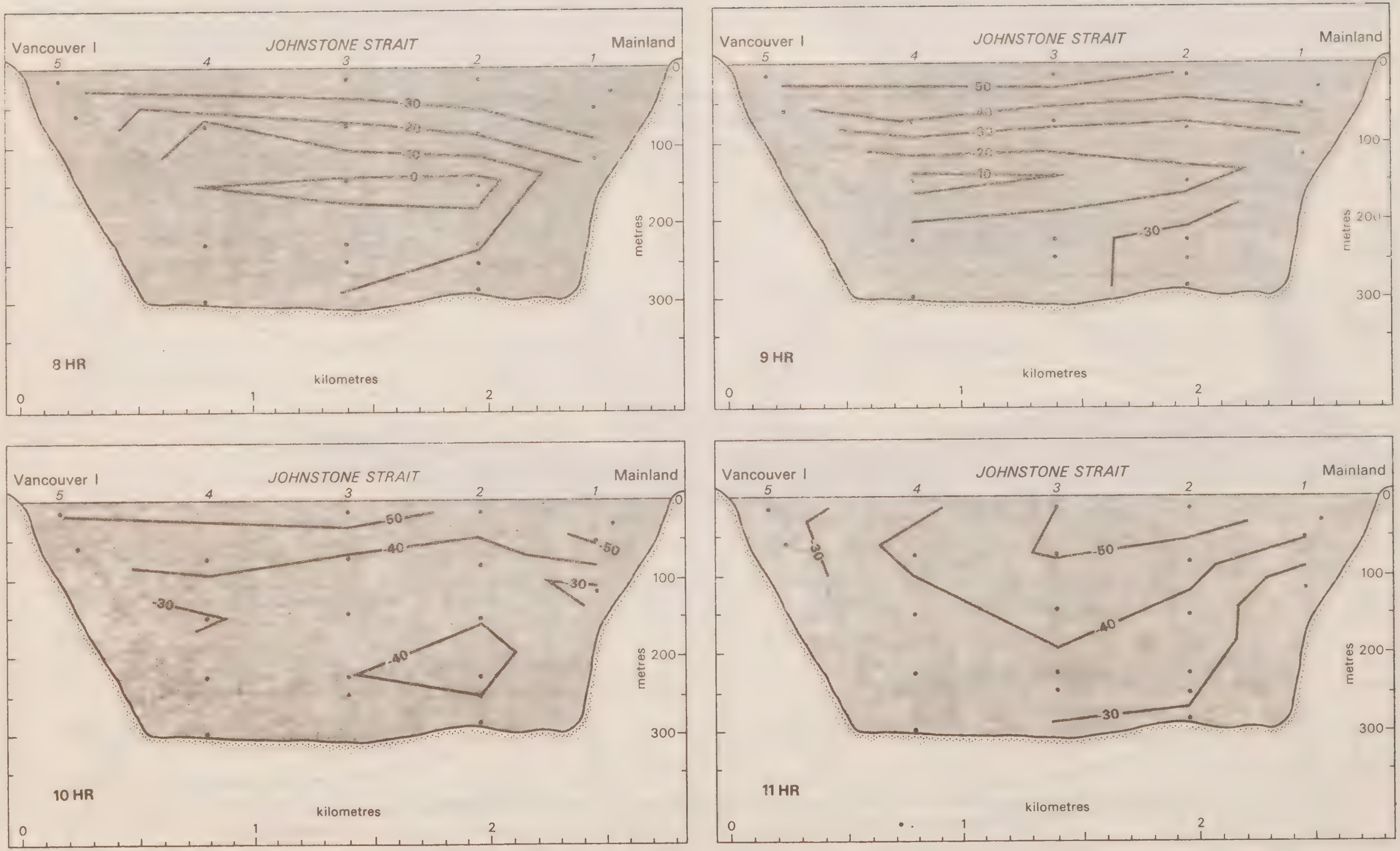


The shaded part of the diagram indicates the ebb tidal stream (west going); the white area indicates the flood tidal stream (east going). The figures within the profile denote cm/sec (51.5 cm/sec equals 1 kn).

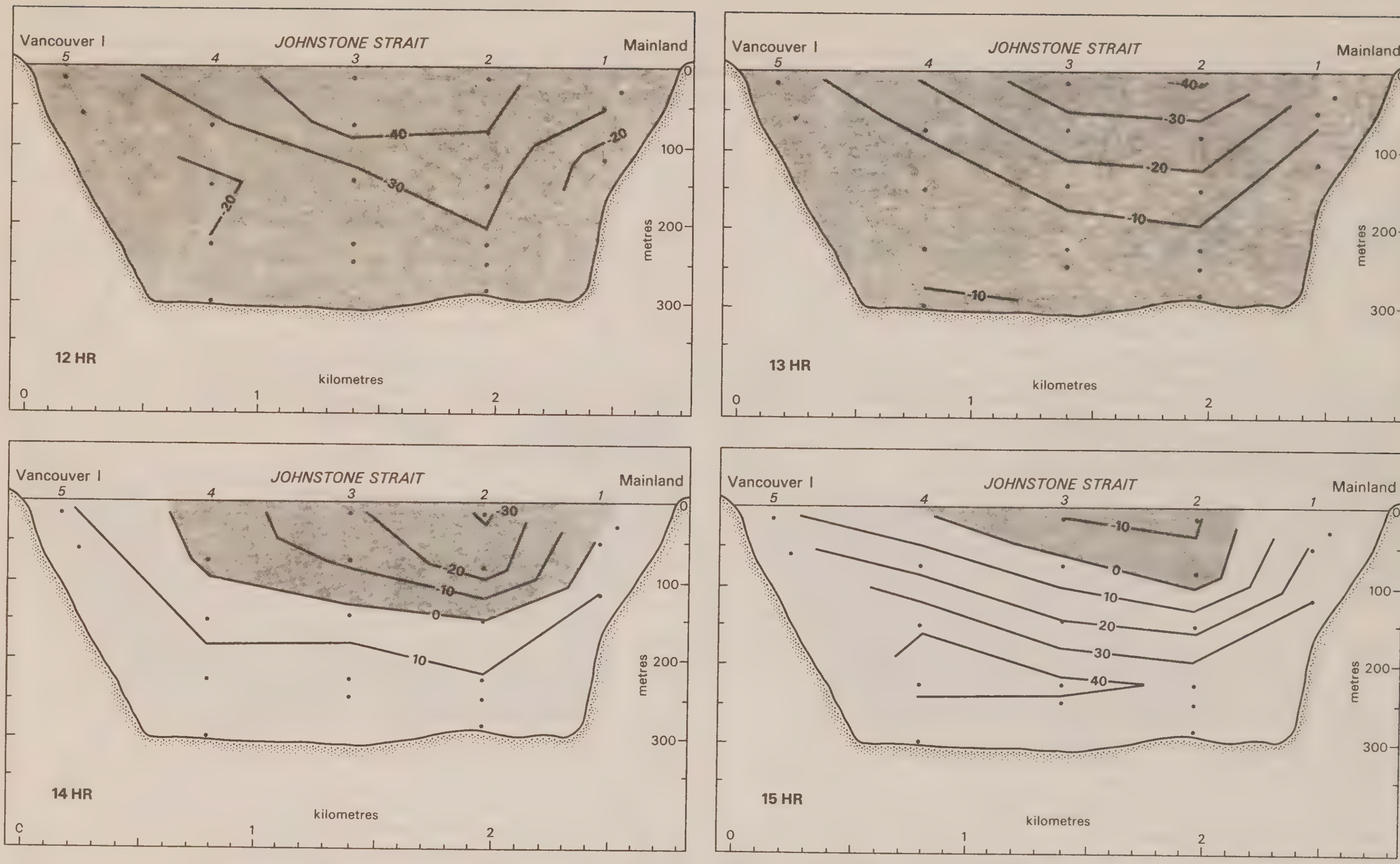
Figure 18. Hourly cross sections at Station 3 showing progress of tidal streams through a tidal cycle, (pages 26–31). The shaded portion denotes ebb currents.



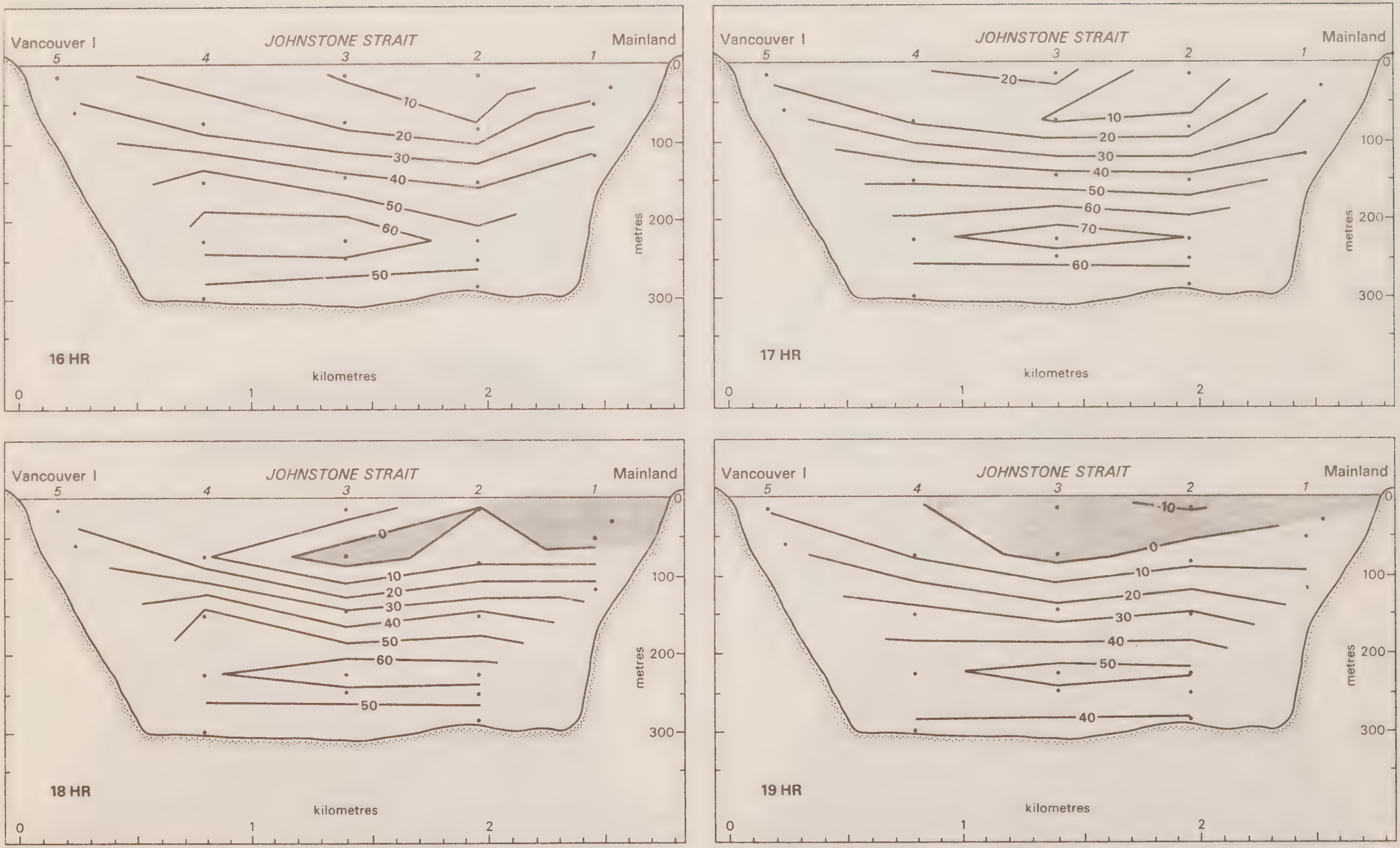
The shaded part of the diagram indicates the ebb tidal stream (west going); the white area indicates the flood tidal stream (east going). The figures within the profile denote cm/sec (51.5 cm/sec equals 1 kn).



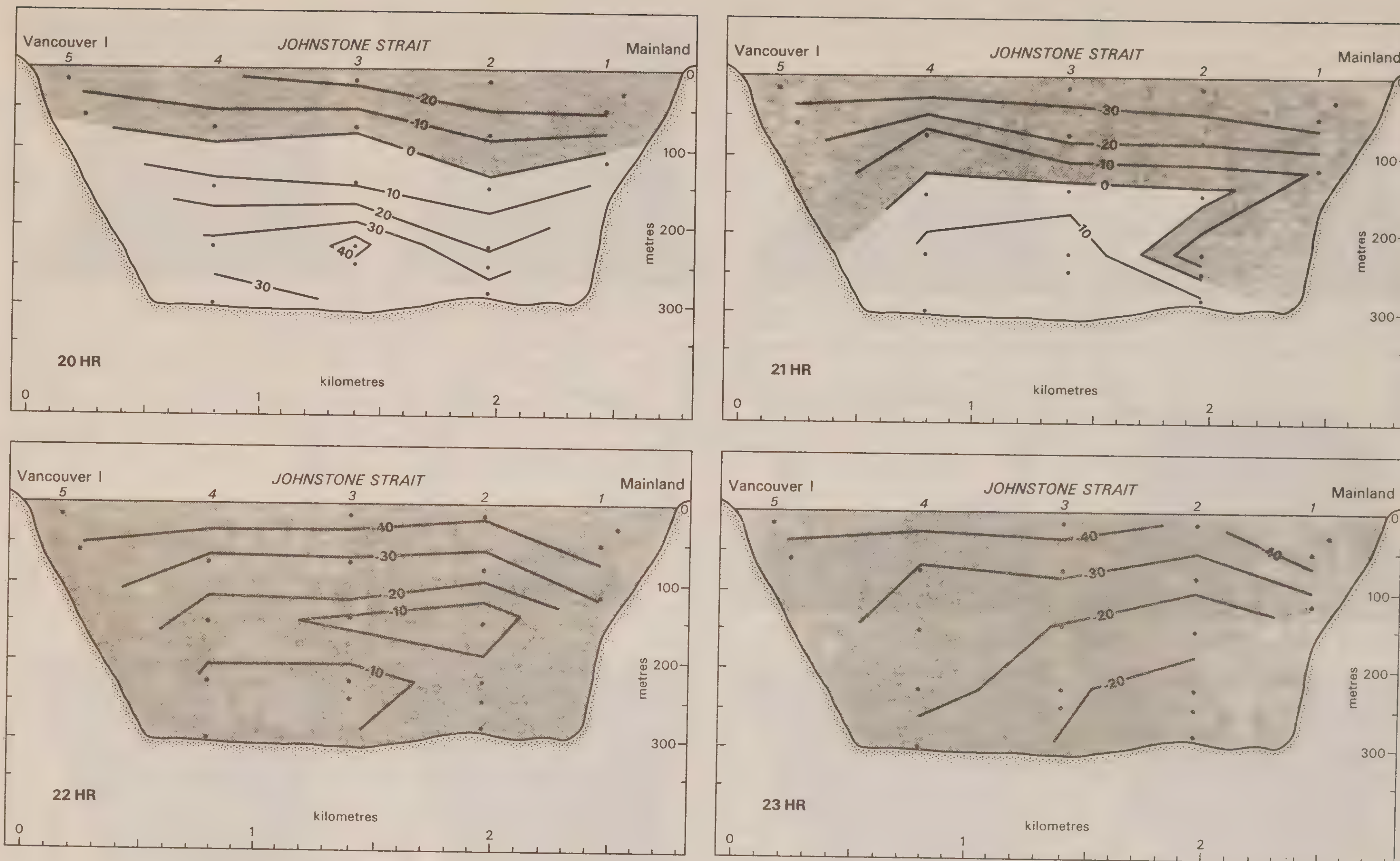
The shaded part of the diagram indicates the ebb tidal stream (west going); the white area indicates the flood tidal stream (east going). The figures within the profile denote cm/sec (51.5 cm/sec equals 1 kn).



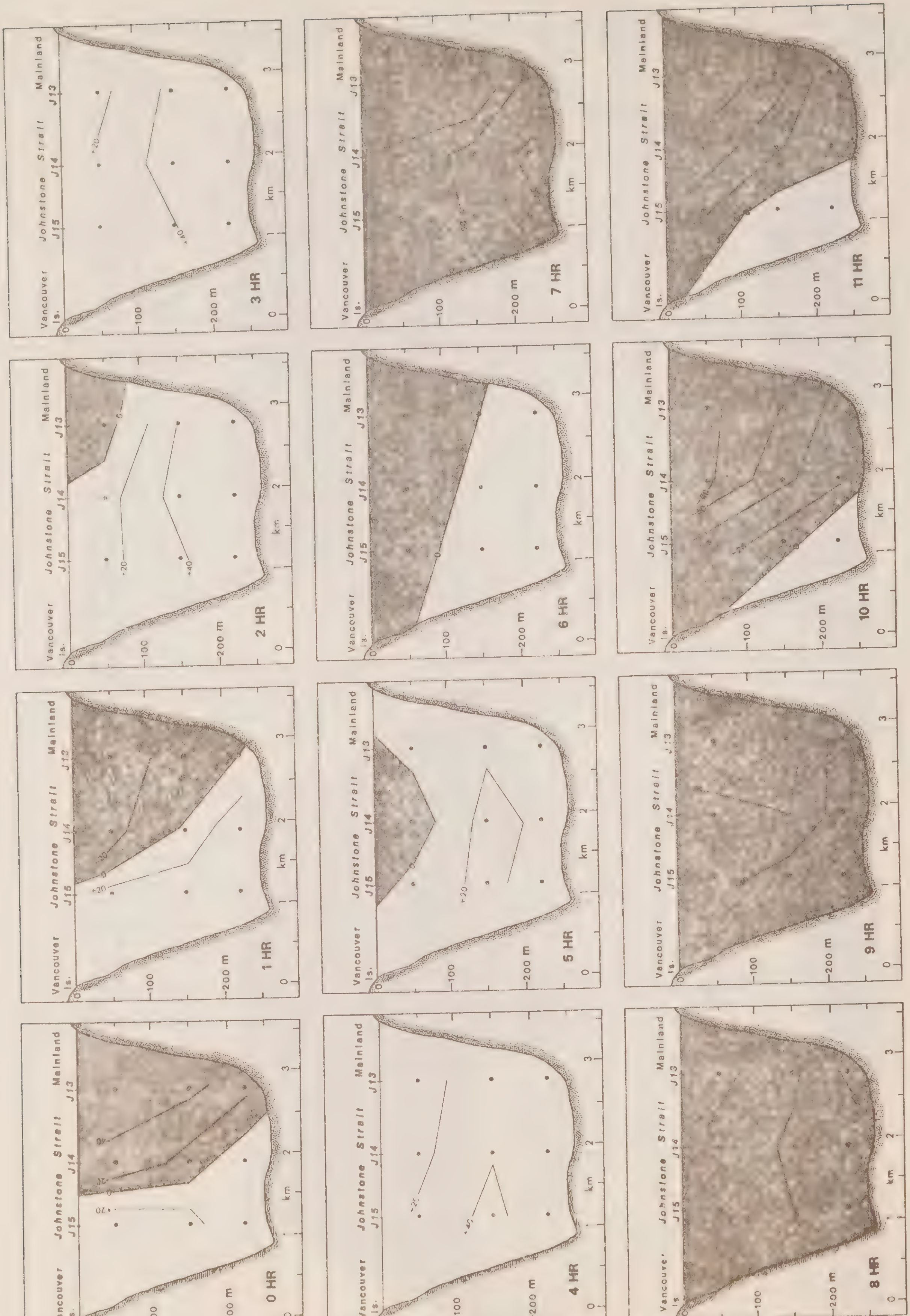
The shaded part of the diagram indicates the ebb tidal stream (west going); the white area indicates the flood tidal stream (east going). The figures within the profile denote cm/sec (51.5 cm/sec equals 1 kn).



The shaded part of the diagram indicates the ebb tidal stream (west going); the white area indicates the flood tidal stream (east going). The figures within the profile denote cm/sec (51.5 cm/sec equals 1 kn).



The shaded part of the diagram indicates the ebb tidal stream (west going); the white area indicates the flood tidal stream (east going). The figures within the profile denote cm/sec (51.5 cm/sec equals 1 kn).


Vancouver Is.
Johnstone Strait
Mainland
J15
J14
J13
0 HR
1 HR
2 HR
3 HR
4 HR
5 HR
6 HR
7 HR
8 HR
9 HR
10 HR
11 HR
100
200 m
km
0
1
2
3

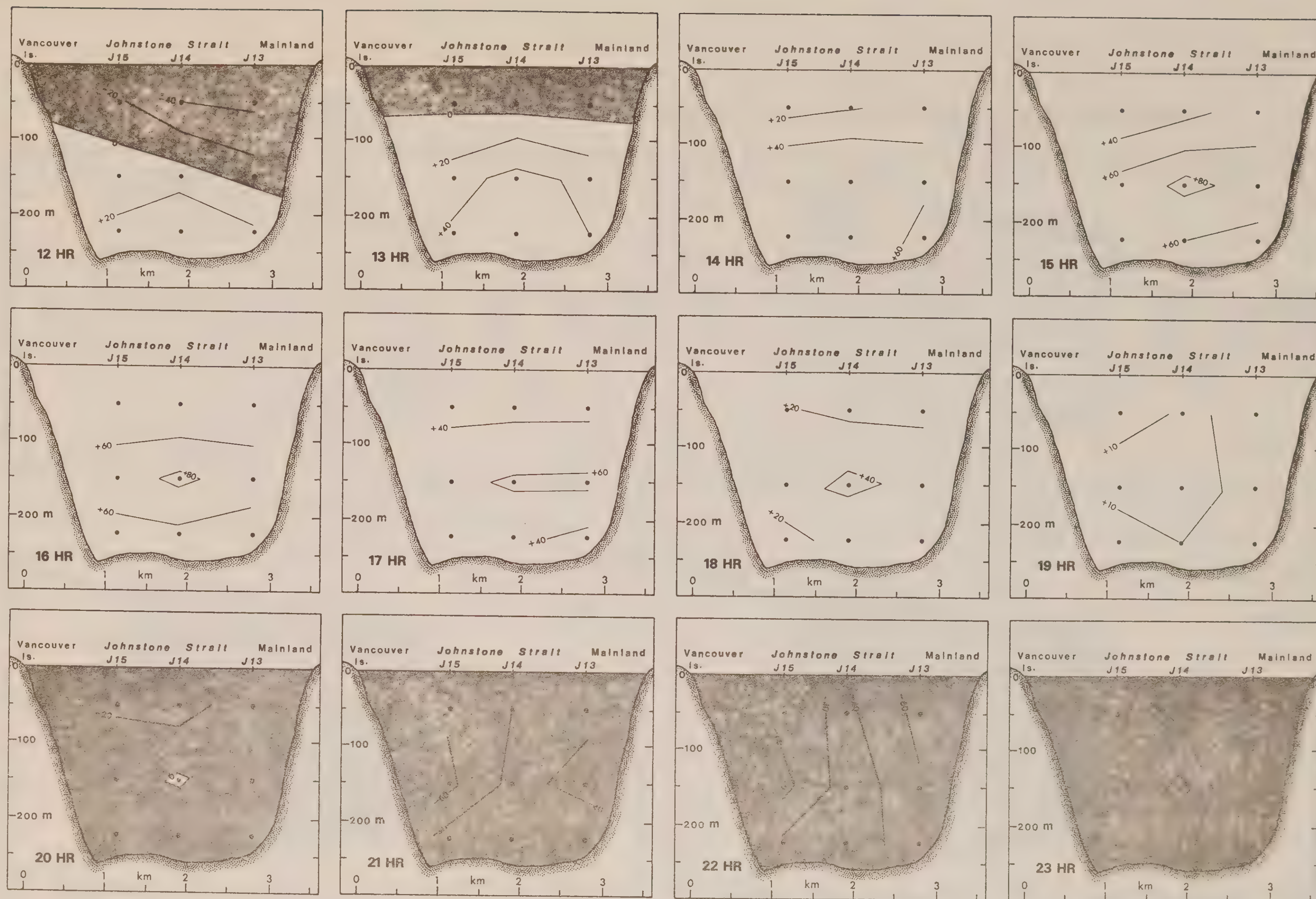


Figure 19. Hourly cross sections at Stations 13, 14 and 15.
The shaded portion denotes ebb currents.

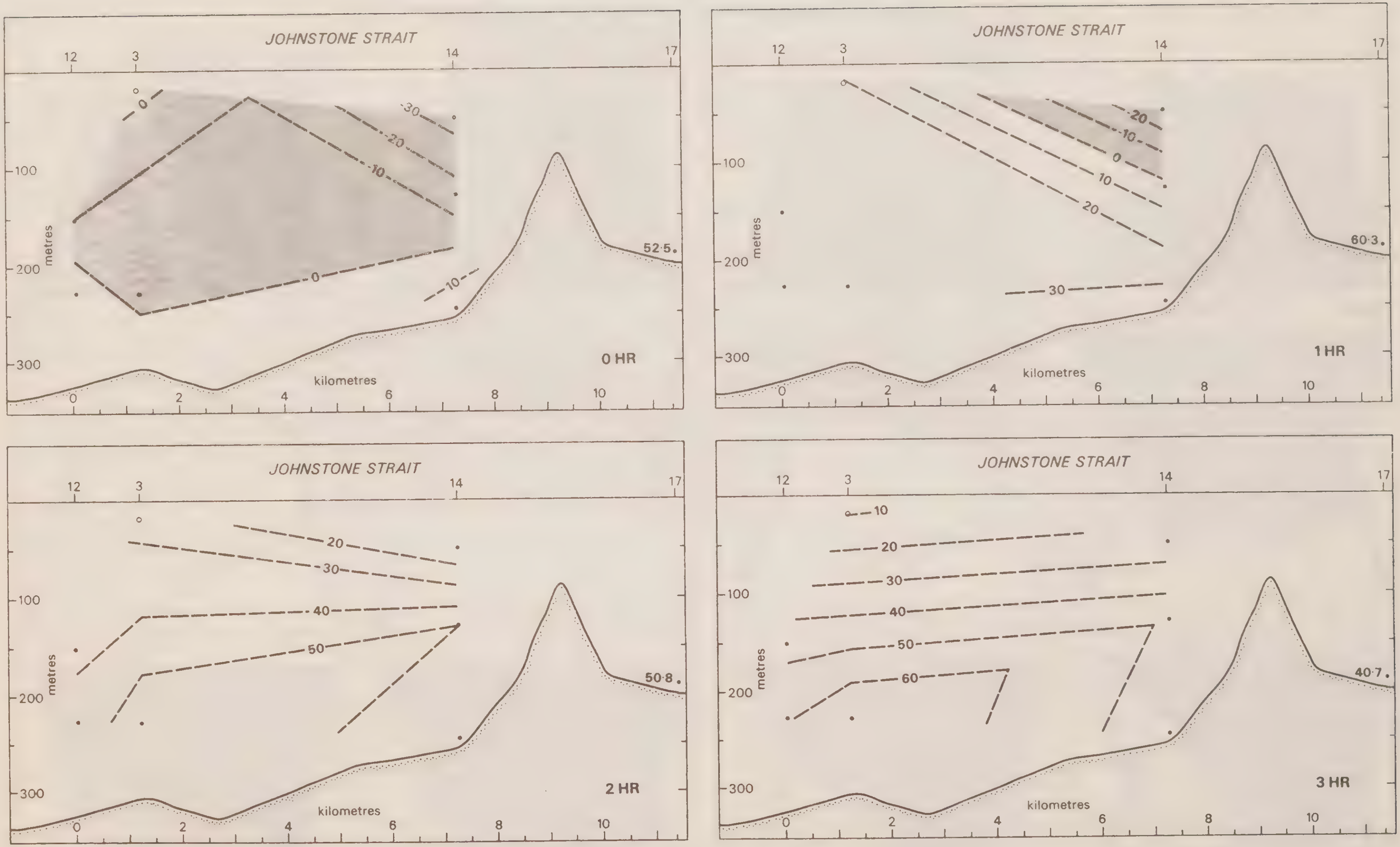
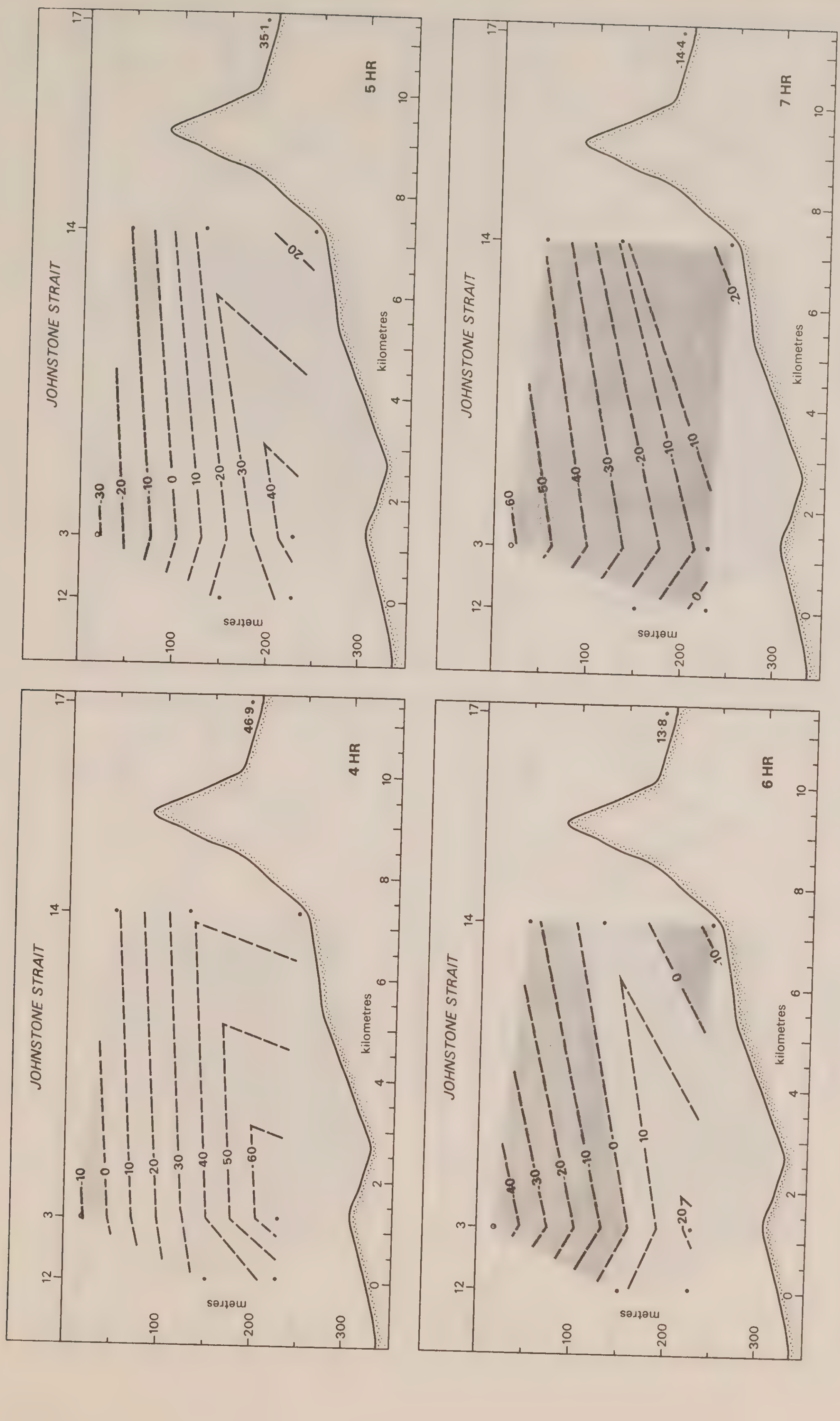
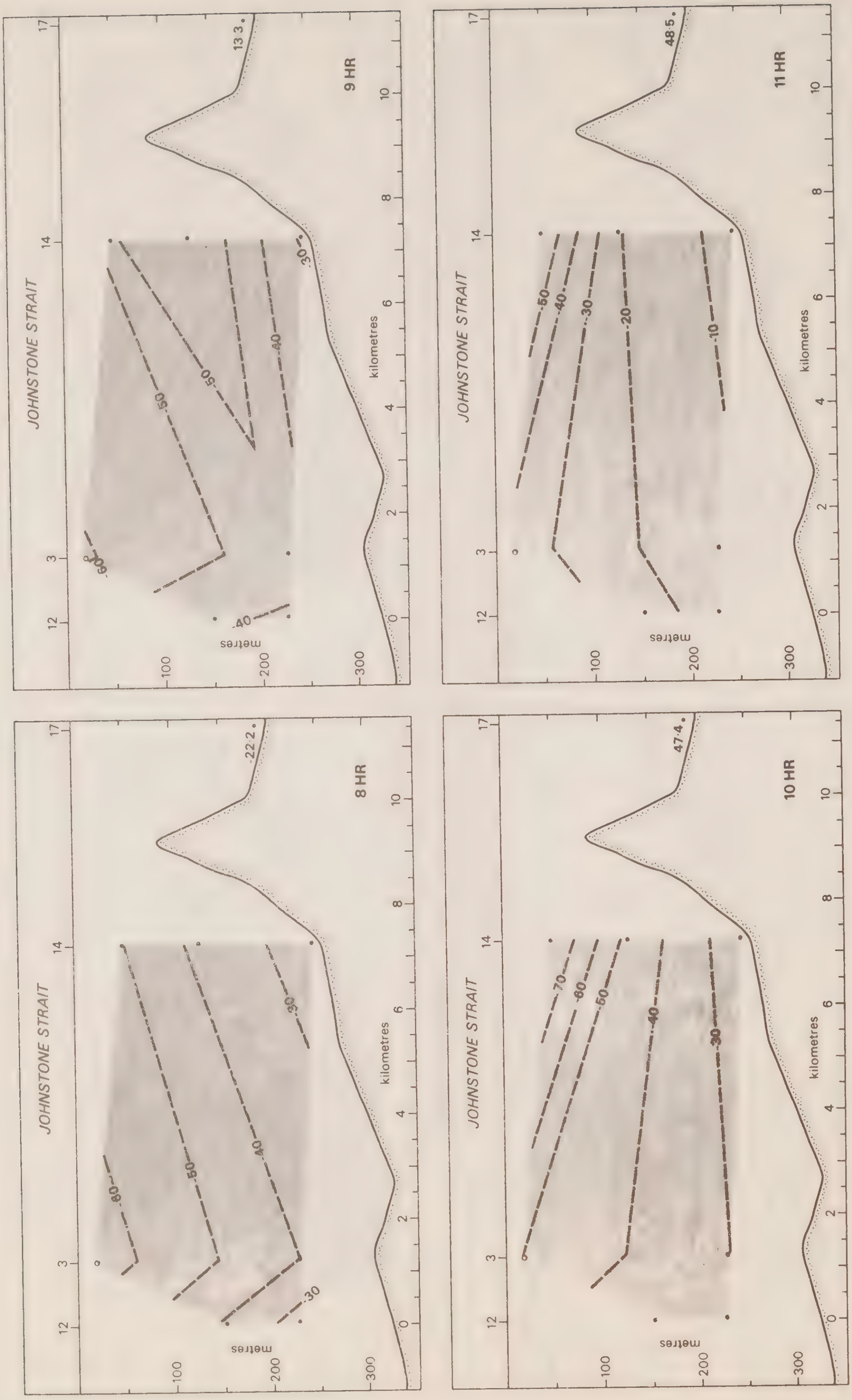
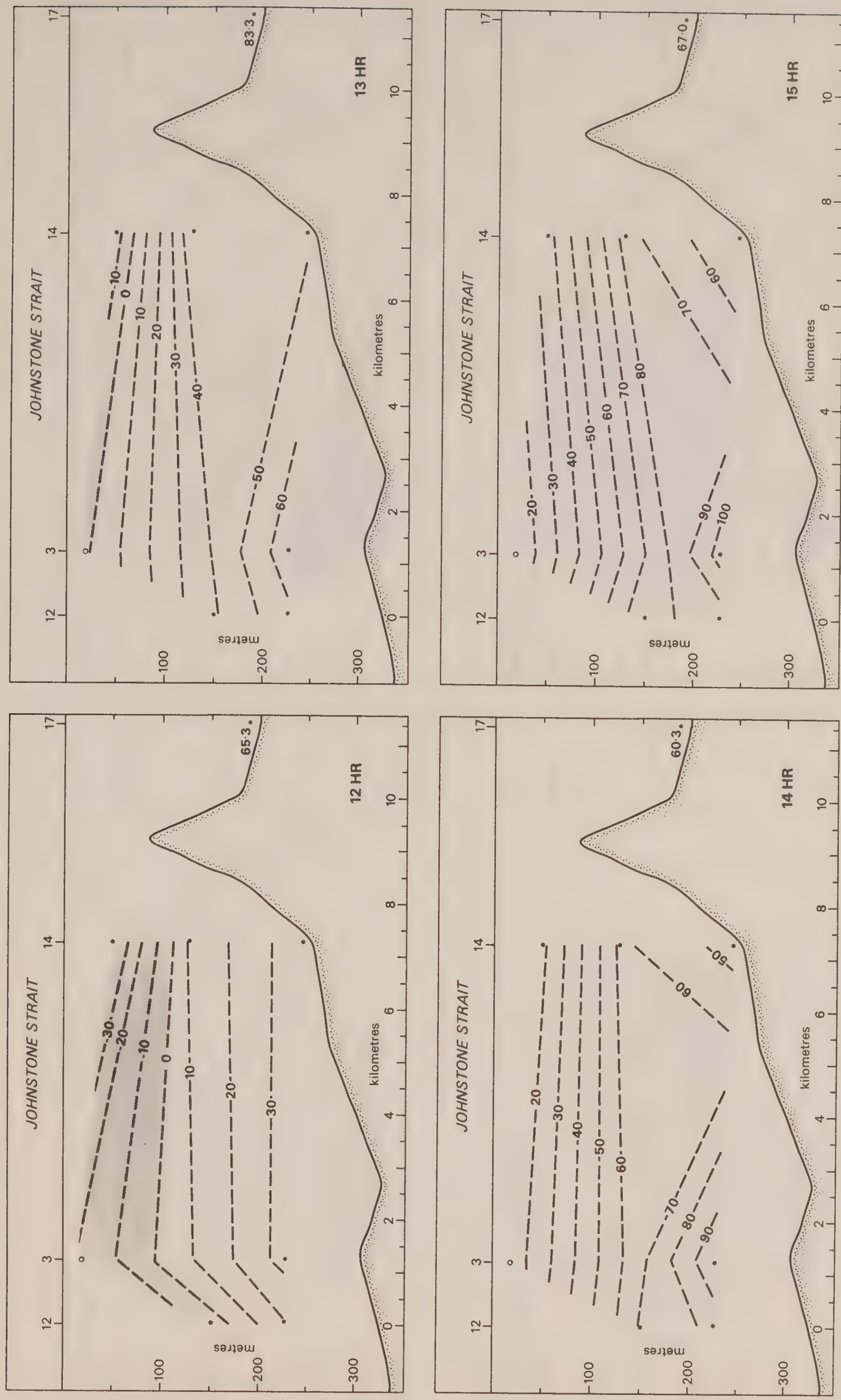


Figure 20. Hourly plots of the current in the centre of the strait between Stations 12 and 17, (pages 34–39).


JOHNSTONE STRAIT
5 HR
35·1
JOHNSTONE STRAIT
7 HR
14·4
JOHNSTONE STRAIT
4 HR
46·9
JOHNSTONE STRAIT
6 HR
13·8
kilometres
metres


JOHNSTONE STRAIT
9 HR
13.3
kilometres
metres
JOHNSTONE STRAIT
11 HR
48.5
kilometres
metres
JOHNSTONE STRAIT
8 HR
22.2
kilometres
metres
JOHNSTONE STRAIT
10 HR
47.4
kilometres
metres



JOHNSTONE STRAIT
13 HR
JOHNSTONE STRAIT
15 HR
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JOHNSTONE STRAIT
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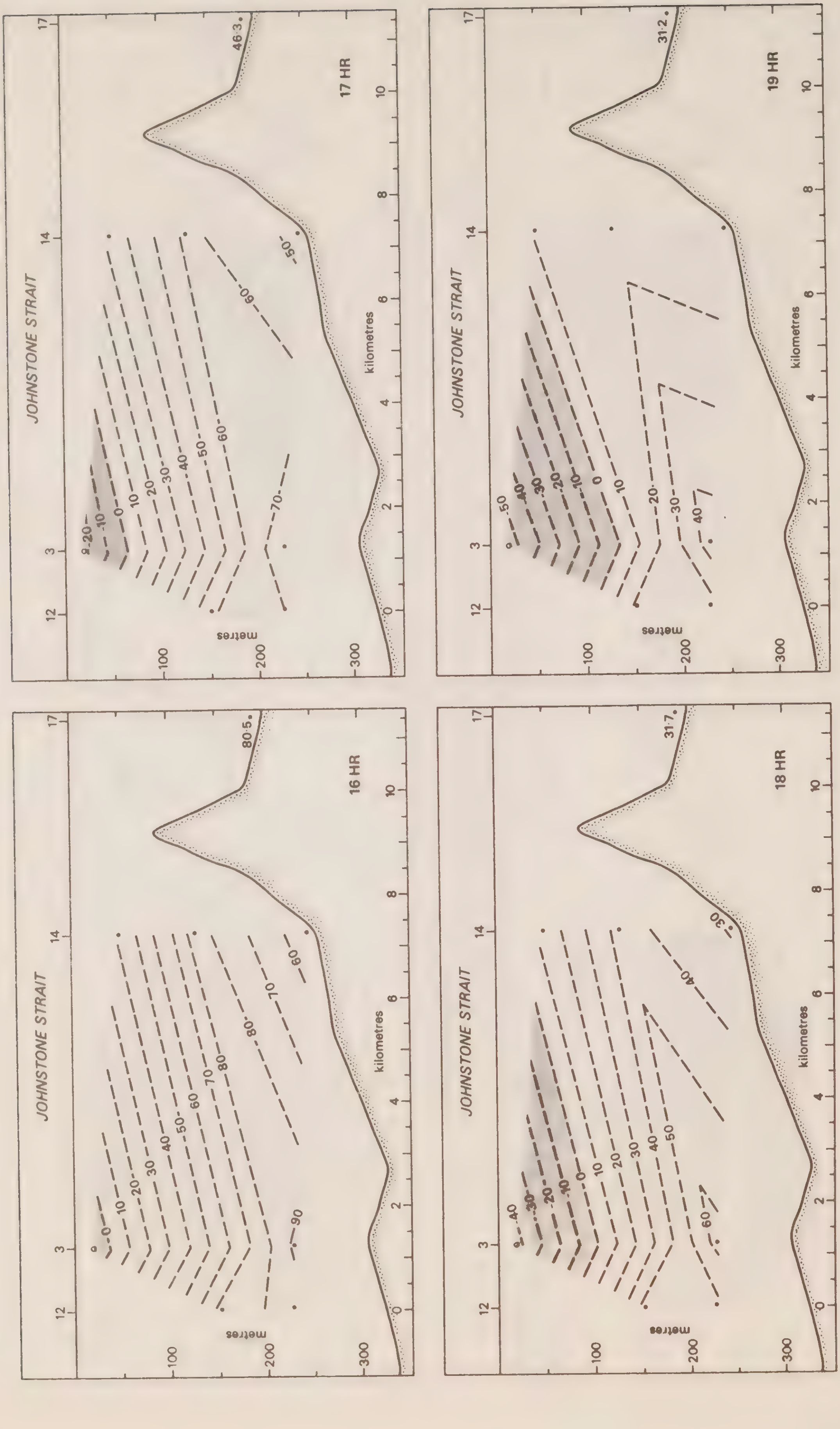
kilometres
metres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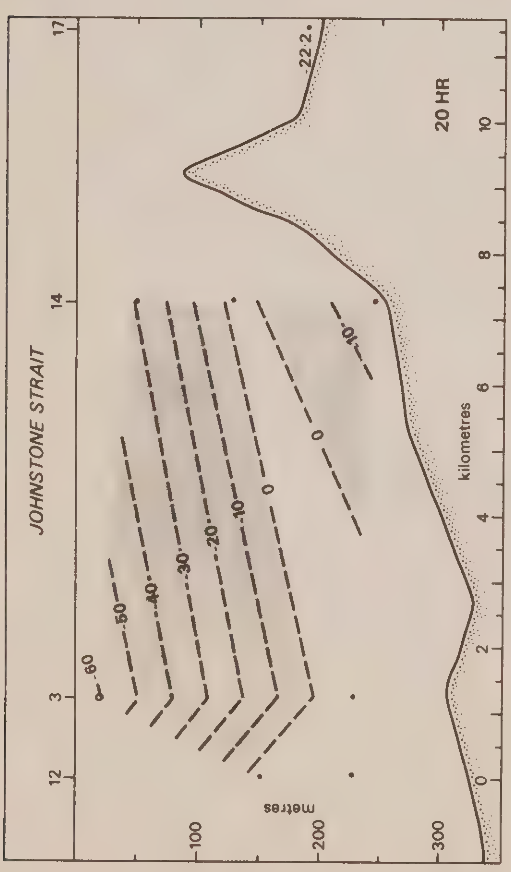
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12
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metres
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-50
-40
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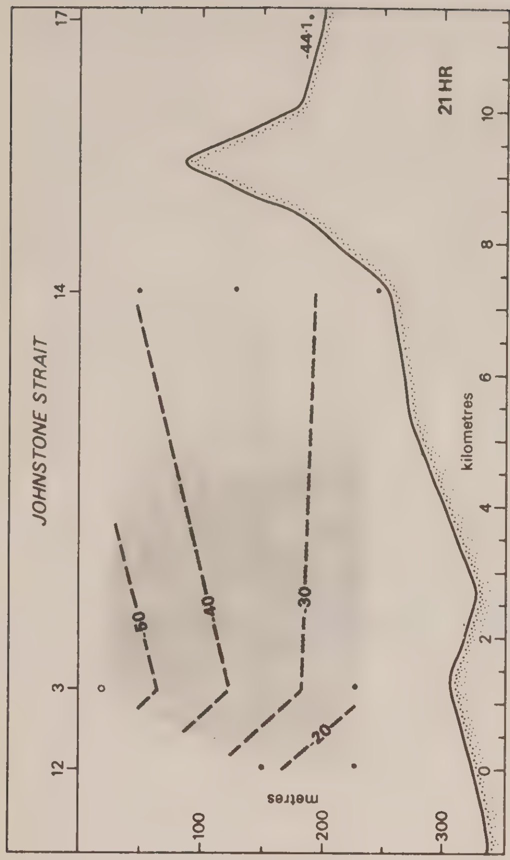
-22·2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metres
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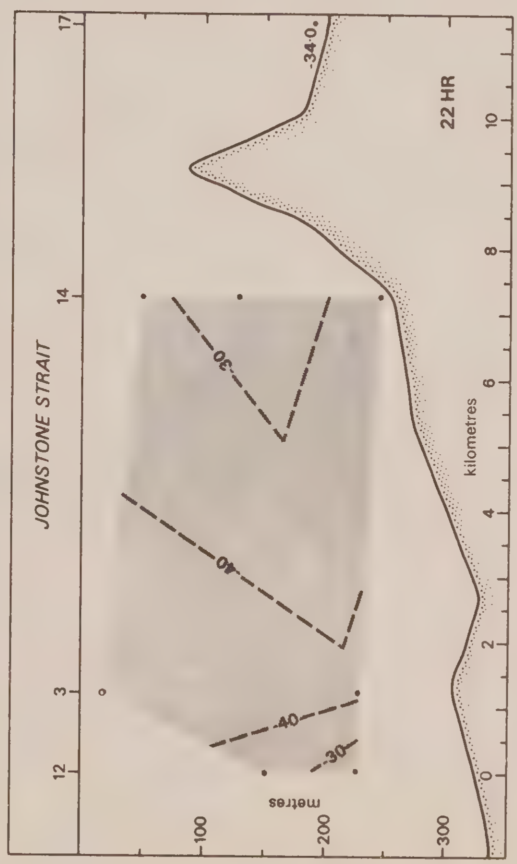
-50
-40
-30
-20
-44·1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12
3
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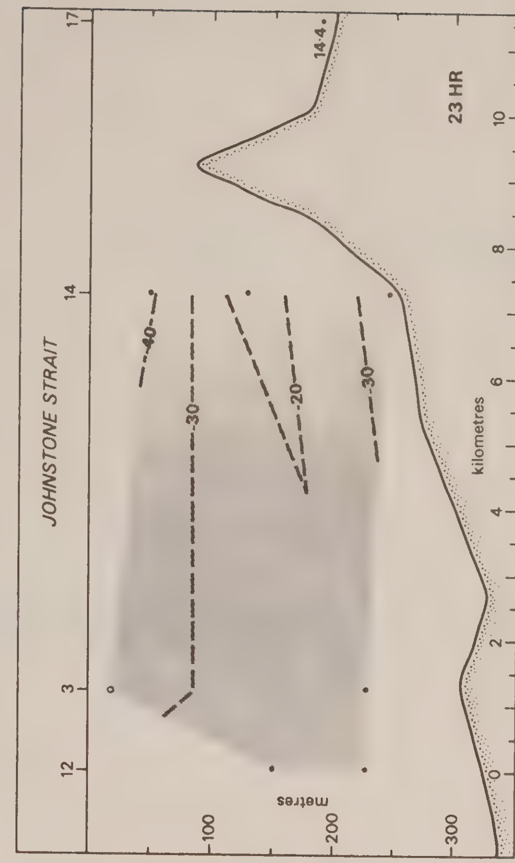
metres
kilometres
-40
-30
-34·0


JOHNSTONE STRAIT
23 HR
12
3
14
17
metres
kilometres
-40
-30
-20
-14·4

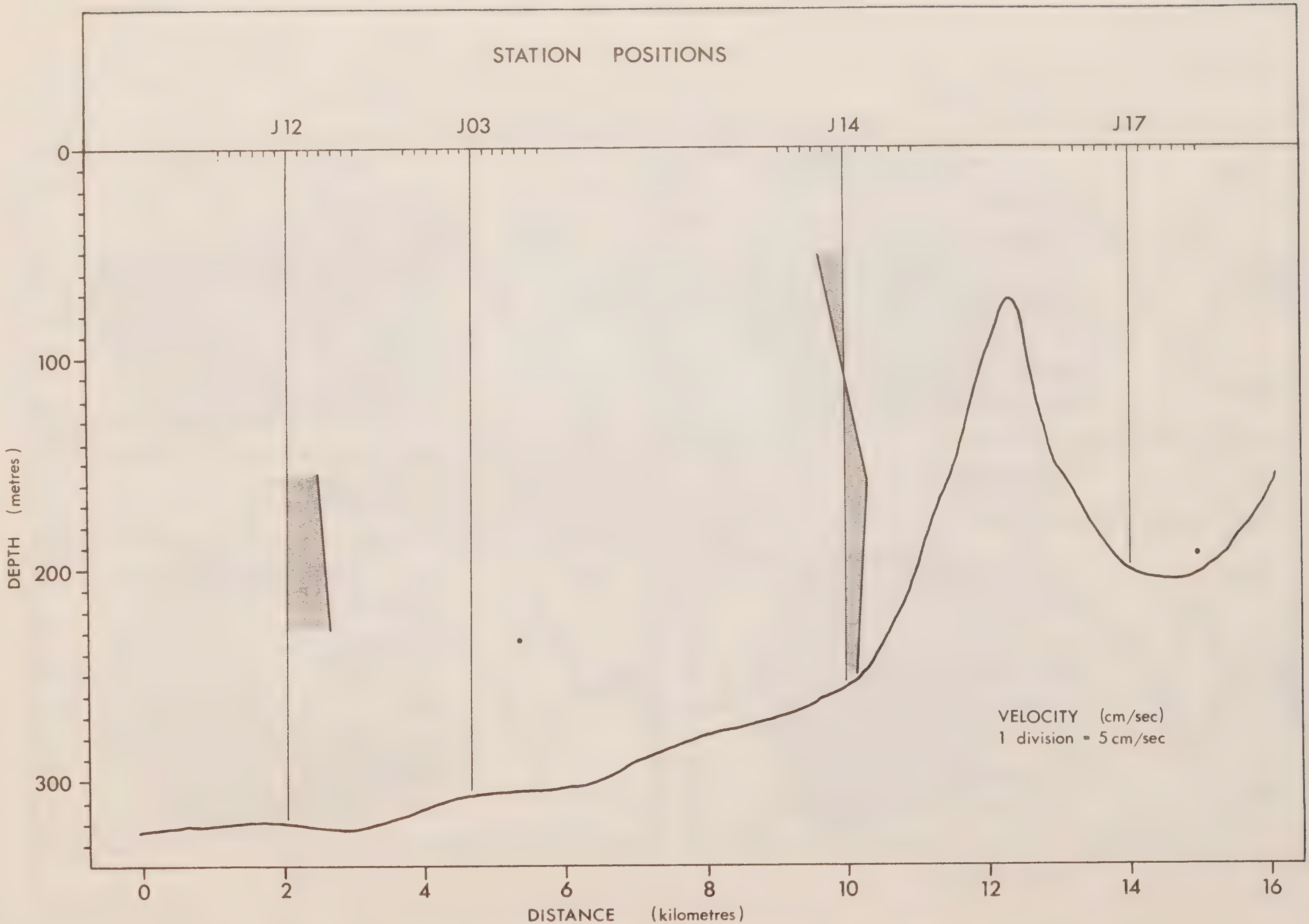


Figure 21. A plot of the residual current in the centre of the strait between Station 12 and 17.

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OBSERVATIONS OF SEAWATER TEMPERATURE AND SALINITY AT BRITISH COLUMBIA SHORE STATIONS 1979

by

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Abstract

Surface (approximately 1-metre-depth) oceanic salinities and temperatures have been recorded once a day at several locations on the coast of British Columbia for varying lengths of time - from a few months to several decades. This publication presents the data obtained in 1979 from nineteen such shore stations. Fifteen of the sites are lightstations operated by the Ministry of Transport. The remaining ones are: The Pacific Biological Station at Departure Bay, the Pacific Environment Institute at West Vancouver, the Bamfield Marine Station at Bamfield, and the Atmospheric Environment Service's meteorological station at Cape St. James.

Temperatures were determined at all nineteen sites by means of mercury-in-glass thermometers. Salinities were obtained at only seventeen locations; they were determined at fourteen by hydrometer, at two by laboratory-model inductive (electrodeless) salinometer, and at one by either salinometer or refractometer.

The data obtained are presented in two forms. Firstly, tables provide, for each site, the monthly means and the associated standard deviations, as well as the maximum and minimum values recorded during each month; the annual means are also listed. Secondly, graphs indicate the behaviour, throughout the year, of the data after the higher-frequency oscillations (e.g., those associated with lunar tides) have been removed ("smoothed") by the use of a seven-day normally-weighted running mean.

Introduction

A program involving once-daily observations of sea-surface salinities and/or temperatures at numerous locations on the coast of British Columbia has been in effect since the early 1930's. Most of these sampling sites have been at lightstations operated by the Ministry of Transport (MOT) or its organizational predecessors. The number of sites reporting at any given time has varied throughout the course of the program; sampling has been discontinued (and in a few cases later resumed) at some places and commenced (not necessarily simultaneously) at others. All available data obtained from these shorestations prior to 1979 have been published (e.g. Hollister and Sandnes, 1972; Giovando, 1980 and 1981).

In 1979, nineteen such locations provided sea-surface data. Fifteen of these were MOT lightstations. The remaining four were: the Pacific Biological Station (of the Department of Fisheries and Environment (DFE)) at Departure Bay; the Pacific Environment Institute (PEI) - also of DFE - at West Vancouver (West Van); the Western Canadian Universities Marine Biological Station at Bamfield; and the meteorological station (of the Atmospheric Environment Service (AES) of DFE) at Cape St. James.

The stations in question are shown (underlined) in Figure 1. Table 1 lists them in *northwest-to-southeast* order, along the "outside coast" (Langara Island to Race Rocks) and along the Strait of Georgia (Cape Mudge to Active Pass); the general location of each station, as well as the names of the observers that obtained the data during 1979, are also given.

Observational Equipment and Procedures

Except at Bamfield, Cape Beale and Active Pass, each daily observation was made at daytime high tide. At Bamfield and Cape Beale, sampling was carried out one hour before the daytime high tide. At Active Pass, observations were done at daylight high-water slack. All sampling times were determined by reference to the Canadian Tide and Current Tables (Fisheries and Environment Canada, 1979). On occasion - because of weather conditions or of the press of the observer's primary duties - the schedule could not be strictly adhered to; however, results obtained *within ± one hour of the desired time* were recorded. For reasons of observer safety, sampling was never attempted in darkness at any station.

At Sheringham Point, the determination of salinity was reinstated on 1 January 1979; temperatures only had been recorded during the period 1 April 1970 through 31 December 1978. At West Vancouver, sampling for *temperature only* was commenced on 3 December 1979.

(a) Temperature

At all *nineteen* stations, water temperature was measured by means of a mercury-in-glass thermometer. At fifteen (all except Departure Bay, West Vancouver, Bamfield and Cape Beale), the thermometers used in 1979 recorded in degrees Fahrenheit ($^{\circ}$F), as has been the case since the inception of sampling. The instruments cover the range -10°

to 145°F, and are graduated in 1° intervals. At the remaining four stations Celsius thermometers, of range -10° to 60° and of interval 0.5°C, were employed. The seawater temperature was estimated to within ±0.1°F or ±0.1°C. (Before being sent to a station, each instrument is checked against a calibrated thermometer; the maximum error allowed is ±0.4°F or ±0.2°C.)

Because of the near-total predominance of the Celsius scale that now prevails in marine affairs, all shorestation sea-surface temperature data obtained subsequent to 1977 have been published in °C. Therefore, for the fifteen stations still utilizing Fahrenheit thermometers in 1979, the original readings were converted to the corresponding Celsius values - rounded off to the first decimal place. The °F thermometers presently in use will be replaced by °C ones (-25 to +55°, interval 1°) as attrition demands.

At all stations except West Vancouver, Cape Beale and Bamfield, the thermometer is (partially) enclosed in a protective case of 2.5-cm (1-in) aluminum pipe; this case also provides a "well" around the bulb of the thermometer. The case is attached to the end of a pole (also of aluminum pipe) which can be as long as about 6 m (20 ft); the greater pole lengths are necessary at sites where observations are carried out from steep bluffs. The thermometer is lowered to a depth of 1 m, and left for about two minutes. It is then raised and the water temperature recorded. At a few of these stations, seawater is obtained by bucket during inclement weather. At West Vancouver and Cape Beale, a bucket is used for all oceanographic observations; at Bamfield a Van Dorn sampling bottle is used at all times. When bucket or bottle is used, the temperature recorded is that obtained by immersion of the thermometer in the water thus collected.

(b) Salinity

Salinities were determined at *seventeen* stations (all except Cape St. James and West Vancouver). At all sites (except Cape St. James[1]) at which the pole assembly is usually utilized, a plastic or glass bottle - usually of about 710-cc (25-oz) capacity - is also attached to the assembly. The uncapped bottle will fill during immersion. At the same time that the temperature of the water is recorded, a sample is drawn from the bottle for use in the determination of salinity. For those sites where a bucket (e.g. Cape Beale) or a bottle (e.g. Bamfield) is used, the salinity sample is drawn from the bucket or bottle.

At all but three of these seventeen stations, the density of each sample was determined by hydrometer. (The salinity, in °/oo (parts per thousand), is then obtained from this value of density.) The hydrometers employed are similar to those used by the U.S. Coast and

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[1] Measurement of salinity was discontinued at Cape St. James on 31 May 1971.

Geodetic Survey (USC&GS) at its tidal stations[2]; they actually measure the *specific gravity*[3] of a seawater sample. Specific gravity is a ratio of two densities and is therefore a dimensionless quantity. If however, by definition, distilled water at a temperature 4°C (39.2°F) has a density $\rho_m=1$, then the specific gravity of a substance having a density ρ is ρ/ρ_m and will be numerically equal to the value of ρ.

The density (or specific gravity) of a seawater sample depends upon both the salinity (the quantity of dissolved material in the sample) *and* the temperature of the sample at the time the measurement is made. Densities determined by hydrometer without temperature control must therefore be reduced to some "standard" temperature for conversion to the corresponding salinities. The standard adopted for this program is 15°C (59°F), the same as that presently used by the USC&GS.

An expression of the general form *Sp. Gr. Tp.* (or *Temp.*) 15/4°C is provided on every hydrometer utilized in this program. It incorporates both the basis of specific gravity (distilled water at 4°C (39.2°F)) and the standard temperature (15°C, or 59°F) employed.

Hydrometers are supplied to the stations in one or more of three ranges of specific gravity: 0.9960 - 1.0110, 1.0100 - 1.0210, and 1.0200 - 1.0310. The scales are divided into intervals of 0.0002, and the values are estimated to ±0.0001; the instruments are read employing techniques described by the USC&GS (Adams, 1942). Each instrument has its calibration checked immediately before being sent to a station.

Salinities at the remaining three stations were determined in 1979 as follows. At Departure Bay, a laboratory inductive (electrodeless) salinometer - an Auto-Lab Model 601 Mark III - was employed. For samples from Bamfield and Cape Beale, a similar type of instrument - in this case a Kahlsico Model RSB-7 - was utilized for about the first half of the year. On both instruments, salinities were estimated to the nearest 0.001%. The accuracy of both these models is claimed to be ±0.003% with duplicate determinations.

It may be noted that "comparison" determinations involving several dozen samples collected at British Columbia shorestations have indicated that about 85% of the "hydrometer" salinity values were within ±0.3°/oo of the corresponding ones obtained by salinometer (Hollister, unpublished).

In about mid-year, the Kahlsico became inoperative. It was found impossible to effect repairs even by the year's end. Subsequent to the instrument's breakdown, samples were analyzed by means of an

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[2]Since 1970, the USC&GS has been a component of the National Ocean Surveys of the National Oceanic and Atmospheric Administration (NOAA).

[3]It should be noted that the term "specific gravity" has recently been replaced, in scientific usage at least, by the term "relative density".

American Optical Corp. salinity refractometer having automatic temperature compensation. The accuracy of this instrument is believed to be about $\pm 0.8^{o}/oo$. Readings were estimated to the equivalent of about $\pm 0.4^{o}/oo$.

The time of each daily observation (usually), as well as the associated seawater temperature and hydrometer, salinometer or refractometer readings, were recorded on monthly field sheets. These sheets were forwarded to West Vancouver, where they underwent preliminary processing.

Preliminary Processing of the Data

The temperature data were scanned, and values were rejected if it was discovered that a faulty thermometer had been used, or if the value was obviously the result of a misreading or of any other error in technique. Observed hydrometer readings were reduced to densities at the standard temperature, $15^{o}C$ ($59^{o}F$), by means of tables prepared by the USC&GS (Zerbe and Taylor, 1953). The appropriate calibration correction was then applied to each such density value. These corrected values were in turn converted to salinities. A salinity value was rejected, again, only if it obviously had resulted from a misreading of hydrometer, salinometer or refractometer or from other procedural errors.

If observations were missing for *one* day or for *two consecutive* days, the resulting gap was filled by value(s) obtained by linear interpolation utilizing the two observations bounding the gap. No interpolation was undertaken in those cases for which readings had been missed for *three or more* consecutive days (whether by accident or by design). Interpolated values were used to provide continuity to graphical representation of the data (see next section).

The salinity values determined by inductive salinometer were reported, in "final" form, to *two* decimal places. Those obtained by hydrometer or by refractometer were reported to only *one* decimal place, because of the lesser accuracy of these instruments compared to that of the salinometer.

Machine Processing of the Data

The daily temperature and salinity data remaining after the preliminary procedures noted above were processed into final form by the Marine Environmental Data Services Branch (MEDS) of Ocean and Aquatic Sciences (OAS), DFE, in Ottawa. For each station, this computer processing involved the determination of the twelve monthly means for temperature and for salinity, as well as of the corresponding standard deviations. The annual means were also computed (Somers, 1965). All such means - except those associated with salinity for months during which a salinometer was utilized - were rounded to *one* decimal place, and the corresponding standard deviations were truncated at the *second* decimal place. The remaining means were rounded to *two* places, and the corresponding standard deviations were truncated at the *third* place. Data obtained by interpolation *were not* utilized in the computation of the means.

A form of smoothing was performed on the data to minimize the effect of any variability associated with frequencies large compared to the annual frequency (those associated with lunar tides, for example). For simplicity, the daily values of salinity and/or temperature at each sampling station were here considered to be equally spaced in time - with a sampling interval, therefore, of 24 hours. A seven-day, normally-weighted running mean (Holloway, 1958) was utilized to smooth the resulting series; this form of filtering is considered to result in an output free of such defects as "polarity reversals" or phase shifts. The running mean was computed, for the entire year, for both temperature and salinity. In order that these means for each station be as continuous as possible consistent with the data involved, daily values obtained by interpolation *were* utilized in the associated computations. However, when a period of greater than *two* consecutive days of missed data was encountered the computations were "interrupted".

Presentation of Data

The data from each station are presented in two forms:

(1) Tabulations, in monthly format, of the daily values of temperature in ^{o}C and of salinity in parts per thousand (^{o}/oo) - pages 17 to 93. The results are listed in the same station order as that given in Table 1. Three months' data are listed on each page. Also recorded for each month are the mean, the standard deviation (STD. DEV.), the number of observations (OBSVNS.) involved in the computations of these two quantities, and the MAXIMUM and MINIMUM values. The *annual* means (YRLY. MEANS) for temperature and salinity are included with the December output for each station. Each interpolated daily value is identified by an asterisk (*). "Missed" values with which no interpolation is associated are denoted by a * followed by a blank space. Invalid days, such as April 31, are indicated by a blank space alone. It should be noted that these designations differ from those that have been previously employed ("*0.0(0)" and "0.00", respectively). Both the latitude and the longitude of each station (in degrees, minutes and seconds) are noted on every page, immediately after the station designation. For ease in reference, the monthly- and annual-mean temperatures and salinities have been summarized. Temperatures in ^{o}C are given in Table 2. In addition, the ^{o}F equivalents of the values in Table 2 are provided in Table 3 - primarily for the convenience of those who, because of either choice or necessity, still employ the Fahrenheit scale. It may be noted that no equivalent given here differs by more than $\pm 0.1^{o}$F from the corresponding value obtained from the "original" Fahrenheit data. Salinities are given in Table 4.

(2) "Annual" graphs of the seven-day, normally-weighted running means for temperature and salinity - pages 95 to 133. These graphs are copies of the computer-generated plots of the means. Any interruption - due to missing data - in the associated computations will result in a gap in the plotted output as well. Each graph for temperature is provided with scales in both ^{o}C and ^{o}F. It is to be noted that the Celsius scale is located on the left-hand side of each graph of temperature, rather than on the right as in previous data reports. Also, the Fahrenheit scale - rather than the Celsius - has been "offset" in the present series of graphs. These changes are intended to emphasize the present preeminence of the Celsius system.

Several features associated with the information presented should be noted:

(a) Circumstances beyond the control of the sampling program have resulted in marked data shortfalls at some stations:

(i) At Bamfield, no oceanographic information whatever was obtained during October through December, and data collected throughout the remainder of the year were sparse (especially so in April and in July through September). In Tables 2, 3 and 4, those months for which 1 to 10 values of temperature or salinity were recorded have been "flagged" (+); it is hoped that this admittedly arbitrary distinction will emphasize the need for circumspection in the use of the information involved.

(ii) At Cape Mudge, no data were obtained during August or September.

(iii) At Departure Bay, observations have *not* - since May 1974 - been carried out on weekends (Saturdays and Sundays) or on statutory holidays. The maximum number of (non-interpolated) values available for determination of each monthly mean has therefore been permanently reduced from, approximately, thirty to twenty at this site.

(b) At Cape Beale, daily salinity values were determined either by inductive salinometer *or* by refractometer during April, June and July. Therefore these values are given to either one or two places of decimals (page 4). However, the computations of the means and standard deviations for these months were carried out on the assumption that all individual values involved were characterized by *two* decimals places (a refractometer - derived value of 32.1 being considered as 32.10, for example). Therefore, although by far the greater number of determinations in each of the three months involved were carried out by salinometer, at best the final decimal place of all calculated quantities should be treated with some discretion.

(c) At Active Pass, the daily salinity values (and the associated running means) during June through August of each year are in general relatively low - quite often <20°/oo. The salinity range utilized for the running-mean graph at Active Pass (page 133) has therefore been chosen to be 18 to 32°/oo, rather than the 20-to-34°/oo range employed elsewhere. It is felt that the *variability* in the mean during the three-month period can thus be better displayed.

(d) At Kains Island, a few salinities of 33°/oo or more were recorded during each of June, July and August of 1979. Such values have also been obtained in some previous years at B.C. shorestations (see e.g. Giovando, 1980). All physical-oceanographic studies so far conducted indicate that such values of salinity are extremely unlikely to occur in the nearshore surface waters of B.C. The observer at the station had previously been apprised of this fact, and therefore checked both equipment and procedures thoroughly during the "high-value"

periods. No obvious faults or errors were revealed; however, with due regard to the uncertainties associated with salinities determined by hydrometer, such values should be regarded with extreme caution pending a satisfactory explanation of their occurrences. These "high" salinities have been retained in the tabular output but have been "flagged" by a double asterisk (**), they have been utilized in the computations of the running means but *not*, arbitrarily, in those of the monthly means.

Brief mention may be made of some recent efforts at analysis (as opposed to "annual" tabulations) of the B.C. shorestation data obtained up to the end of 1976. A preliminary study (Webster and Farmer, 1976) examined data from three of the stations on the outer coast - Langara Island, Kains Island and Amphitrite Point. The primary purpose was the development of techniques for the presentation of important features of the data - such as long- and short-term variations at each station, and the possible relationships between the data from different stations. The techniques applied were simple annual and monthly averaging, and the relatively modern technique of spectral analysis. The same authors later extended these analytical techniques to a further fourteen stations (Webster and Farmer, 1977).

A third publication (Associated Engineering Services Ltd., 1977) deals with the general efficiency of the present shorestation sampling program, especially in the light of financial constraints involved. Sampling errors, especially those inherent in salinity determination by hydrometry, are exhaustively discussed. Central to the study was a questionnaire - forwarded to all present and potential users of the data - seeking to clarify such information as the time scales of interest and the required accuracy of the data. Responses to this questionnaire, and the sampling accuracies determined, were utilized to prepare several options (further versions of the sampling program). These options, each of different sampling intensities and/or instrumentation mixes, and cost, are presented for consideration by the users.

Acknowledgements

The sea-sampling program at British Columbia shore stations owes its success primarily to the dedication of the many observers who are taking, or have taken, part in the obtaining of data. These observers have maintained a remarkable continuity of effort, often in the face of extremely hazardous sea and weather conditions. The several vital contributions of MOT to the program are gratefully acknowledged; the provision of the voluntary services of the lightkeepers as observers, as well as the excellent assistance received from the District Managers and Staffs of the Marine Transportation Division in Victoria and Prince Rupert, and from its Radio Branch, which transmits the numerous messages involved in the program. The services of the meteorological staff at Cape St. James have been made available to the program through the kind permission of the Regional Director of the Pacific Region of AES. The observers at all stations except Bamfield, Cape Beale and Departure Bay receive payment from Ocean and Aquatic Sciences, DFE, for their work on behalf of the program. Observations at Bamfield are carried out by members of the support staff; the observer at Cape Beale is paid by Bamfield. Thanks are due to the former Director at Bamfield, Dr. J.E. McInerney, for permission to publish the Bamfield and Cape Beale data included in this

report, and to Miss Sabina Leader for her efforts in making these data available. The computations were carried out by the Data Processing and Analysis Section of MEDS, under the direction of Mr. J. Nasr.

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Figure 1. Location of B.C. shore stations (underlined) making daily oceanographic observations (1979) reported in this publication.

Table 1. B.C. shore stations providing the oceanographic data reported in this publication: general locations, and names of observers.

STATION	LOCATION	OBSERVER(S)
<u>Outside Coast</u>		
Langara Island	Dixon Entrance, south side	J.E. Redhead (Mrs.)
Bonilla Island	Hecate Strait, north	M. Slater D. Graham J. Beaudet
Cape St. James	Queen Charlotte Islands, south end	D. Veale D. Geiger R. Dobinson
McInnes Island	Milbanke Sound entrance, north side	K. Coldwell (Mrs.)
Egg Island	Smith Sound, southern entrance	K. Ashe (Mrs.) S.G. Westhaver R.E. Akerstrom
Pine Island	Queen Charlotte Strait, western entrance	K.E. Watson (Mrs.) S.E. Plumpton (Mrs.) L. Bablitz (Mrs.) S.A. Lee (Mrs.)
Kains Island	Quatsino Sound entrance, north side	L.C. Collins (Mrs.) R.W. Moe
Amphitrite Point	Barkley Sound, western entrance	M.V. Stewart (Mrs.)
Cape Beale	Barkley Sound, eastern entrance	A.D. Thomson
Bamfield	Barkley Sound, near eastern entrance	R. Miller (Miss)
Sheringham Point	Juan de Fuca Strait, northern shore	E. Bruton (Mrs.)
Race Rocks	Juan de Fuca Strait, eastern end	F.B. Anderson (Mrs.)

Table 1 continued

STATION	LOCATION	OBSERVER(S)
<u>Strait of Georgia</u>		
Cape Mudge	Strait of Georgia, northern entrance	R. Wilkie J. Collette J.A. Abram S. Terrill
Chrome Island	Strait of Georgia, off central western shore	F.M. Collette (Mrs.) K.E. Watson (Mrs.) C. Restall J. Etzkorn (Mrs.)
Sisters Island	Strait of Georgia, central	W. Milne D.J. McNeil R.W. Emrich R.J. Grunert
Departure Bay	Strait of Georgia, central western shore	A. Ballantyne (Mrs.)
Entrance Island	Strait of Georgia, off central western shore	E. Cehak (Mrs.)
West Vancouver	Strait of Georgia, central eastern shore	A. Lamb P. Edgell
Active Pass	Strait of Georgia, southwestern shore	J.E. Ruck

Table 2. Monthly- and annual-mean temperatures (^{o}C) - 1979

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Langara I.	5.4	4.7	6.2	7.4	8.9	10.1	12.2	12.6	13.6	11.9	9.4	7.6	9.2
Bonilla I.	5.4	5.0	6.3	7.6	9.3	11.2	12.0	12.2	12.7	11.7	9.7	8.2	9.3
McInnes I.	5.9	5.6	6.4	8.1	10.0	11.4	13.5	14.3	14.1	12.1	9.3	8.0	9.8
Cape St. James	6.6	6.3	7.0	7.7	8.7	9.6	11.3	13.3	11.6	10.7	10.1	9.2	9.4
Egg I.	6.0	5.8	7.0	8.4	10.6	12.6	12.6	13.1	13.1	10.3	9.4	8.8	9.8
Pine I.	7.0	6.6	7.0	7.5	8.2	9.1	9.9	10.1	10.7	10.4	9.7	8.9	8.8
Kains I.	6.8	6.5	7.7	8.8	10.8	11.7	13.5	14.2	14.9	12.5	10.4	9.5	10.6
Amphitrite Pt.	6.0	6.1	8.1	9.2	11.5	11.6	13.6	14.0	14.9	12.4	10.6	9.7	10.7
Cape Beale	6.3	6.4	8.2	9.5	11.8	11.8	12.1	12.6	12.8	10.4	10.5	9.7	10.2
Bamfield	6.6	6.3	+8.7	+10.0	+13.6	+14.8	+16.2	+15.5	+17.1	-	-	-	-++
Sheringham Pt.	6.6	6.7	7.8	8.8	10.2	10.6	11.1	11.1	11.7	10.4	9.7	8.7	9.5
Race Rocks	6.6	6.9	7.6	8.4	9.5	10.0	10.9	10.8	10.5	9.9	9.1	8.6	9.1
Cape Mudge	7.1	7.5	7.7	8.4	9.8	11.7	13.5	-	-	11.0	8.4	7.7	9.3
Sisters I.	6.7	6.9	7.9	9.1	12.5	15.5	16.9	18.4	15.0	12.3	9.2	8.1	11.6
Chrome I.	6.9	7.2	8.0	9.6	12.1	15.3	16.3	17.0	13.9	11.6	9.3	8.4	11.3
Departure Bay	6.7	6.3	8.0	9.7	13.0	15.6	16.7	17.7	15.0	12.2	9.0	7.7	11.5
Entrance I.	7.2	7.3	7.8	8.8	12.0	14.8	16.5	17.6	14.4	12.0	9.3	8.2	11.3
West Vancouver	-	-	-	-	-	-	-	-	-	-	-	8.0	-++
Active Pass	6.2	6.8	7.9	9.3	11.4	14.0	15.4	15.4	13.8	11.6	9.0	8.3	10.8

Note: - Signifies no data obtained
+ Signifies months with 1 to 10 daily values of temperature recorded
-++ Signifies annual mean not listed, being considered unrepresentative because of general lack of data during the year

Table 3. Monthly- and annual-mean temperatures (°F) - 1979

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Langara I.	41.7	40.5	43.2	45.3	48.0	50.2	54.0	54.7	56.5	53.4	48.9	45.7	48.6
Bonilla I.	41.7	41.0	43.3	45.7	48.7	52.2	53.6	54.0	54.9	53.1	49.5	46.8	48.7
McInnes I.	42.6	42.1	43.5	46.6	50.0	52.5	56.3	57.7	57.4	53.8	48.7	46.4	49.6
Cape St. James	43.9	43.3	44.6	45.9	47.7	49.3	52.3	55.9	52.9	51.3	50.2	48.6	48.9
Egg I.	42.8	42.4	44.6	47.1	51.1	54.7	54.7	55.6	55.6	50.5	48.9	47.8	49.6
Pine I.	44.6	43.9	44.6	45.5	46.8	48.4	49.8	50.2	51.3	50.7	49.5	48.0	47.8
Kains I.	44.2	43.7	45.9	47.8	51.4	53.1	56.3	57.6	58.8	54.5	50.7	49.1	51.1
Amphitrite Pt.	42.8	43.0	46.6	48.6	52.7	52.9	56.5	57.2	58.8	54.3	51.1	49.5	51.3
Cape Beale	43.3	43.5	46.8	49.1	53.2	53.2	53.8	54.7	55.0	50.7	50.9	49.5	50.4
Bamfield	43.9	43.3	+47.7	+50.0	+56.5	+58.6	+61.2	+59.9	+62.8	-	-	-	-++
Sheringham Pt.	43.9	44.1	46.0	47.8	50.4	51.1	52.0	52.0	53.1	50.7	49.5	47.7	49.1
Race Rocks	43.9	44.4	45.7	47.1	49.1	50.0	51.6	51.4	50.9	49.8	48.4	47.5	48.4
Cape Mudge	44.8	45.5	45.9	47.1	49.6	53.1	56.3	-	-	51.8	47.1	45.9	48.7
Sisters I.	44.1	44.4	46.2	48.4	54.5	59.9	62.4	65.1	59.0	54.1	48.6	46.6	52.9
Chrome I.	44.4	45.0	46.4	49.3	53.8	59.5	61.3	62.6	57.0	52.9	48.7	47.1	52.3
Departure Bay	44.1	43.3	46.4	49.5	55.4	60.1	62.1	63.9	59.0	54.0	48.2	45.9	52.7
Entrance I.	45.0	45.1	46.0	47.8	53.6	58.6	61.7	63.7	57.9	53.6	48.7	46.8	52.3
West Vancouver	-	-	-	-	-	-	-	-	-	-	-	46.4	-++
Active Pass	43.2	44.2	46.2	48.7	52.5	57.2	59.7	59.7	56.8	52.9	48.2	46.9	51.4

Note: - Signifies no data obtained

\+ Signifies months with 1 to 10 daily values of temperature recorded

-++ Signifies annual mean not listed, being considered unrepresentative because of general lack of data during the year

Table 4. Monthly- and annual-mean salinities ($^{o}/oo$) - 1979

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Langara I.	31.6	31.8	31.9	31.9	32.2	32.1	31.1	31.8	31.9	31.9	31.9	31.9	31.8
Bonilla I.	31.1	31.2	31.1	31.0	31.1	30.9	30.9	30.9	30.8	30.7	30.8	30.8	31.0
McInnes I.	31.7	32.1	31.4	31.3	31.6	30.9	30.8	31.6	31.3	31.0	31.1	30.8	31.3
Egg I.	31.9	31.8	31.3	30.9	29.8	27.7	29.5	30.0	31.2	31.2	31.8	31.6	30.7
Pine I.	31.5	31.3	31.0	31.3	31.9	32.0	31.6	32.0	32.4	32.1	31.9	31.5	31.7
Kains I.	31.4	30.7	29.8	31.0	31.7	32.2	32.4	32.6	31.4	31.0	30.3	28.9	31.1
Amphitrite Pt.	30.8	28.6	28.3	30.4	30.9	31.4	31.2	31.4	30.0	30.4	29.5	29.0	30.2
**Cape Beale	31.58	29.68	29.91	31.41	30.5	31.73	31.46	31.3	30.8	31.2	31.0	29.1	30.82
*Bamfield	+31.61	28.00	+26.99	+27.68	+27.06	+27.21	-	-	-	-	-	-	-++
Sheringham Pt.	31.8	31.2	30.9	31.7	32.0	31.9	31.7	31.8	31.1	31.4	31.3	30.9	31.5
Race Rocks	31.4	31.2	31.4	31.6	31.6	31.6	31.5	31.6	31.5	31.5	31.4	31.5	31.5
Cape Mudge	29.2	29.1	29.3	29.6	29.9	28.7	27.1	-	-	28.6	28.5	28.7	28.9
Sisters I.	29.4	29.7	29.4	29.5	28.8	25.3	24.5	26.4	26.5	28.0	28.4	28.6	27.9
Chrome I.	29.4	29.3	29.3	29.6	29.5	28.4	26.9	28.1	28.6	29.1	29.1	29.3	28.9
*Departure Bay	29.43	27.88	28.02	28.69	26.35	24.68	24.89	24.97	25.92	27.18	27.88	25.06	26.76
Entrance I.	29.1	29.2	28.1	28.2	26.7	25.4	24.6	24.9	26.5	27.4	27.9	28.0	27.2
Active Pass	29.1	29.6	28.6	29.2	27.2	25.5	24.9	25.9	26.4	27.9	27.6	29.3	27.6

Note: Values were determined by inductive salinometer (*), or by either inductive salinometer or refractometer (**)

- Signifies no data obtained

+ Signifies months with 1 to 10 daily values of salinity recorded

-++ Signifies annual mean not listed, being considered unrepresentative because of general lack of data during the year

Tabulations of Daily Sea-surface

Temperature and Salinity

1979

TEMP: Temperature (^{o}C)

SAL: Salinity (^{o}/oo)

LANGARA ISLAND 54 15 19 N 133 03 30 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	5.7	31.2	5.8	32.0	4.8	31.9
2	6.1	31.9	* 5.7	* 31.8	5.7	31.8
3	5.2	31.5	5.6	31.6	5.8	32.0
4	5.6	31.6	5.8	31.5	5.6	32.0
5	5.5	31.9	5.6	31.9	6.2	32.0
6	4.8	31.6	5.3	31.2	6.0	31.8
7	5.1	31.2	5.1	31.4	5.7	31.6
8	4.6	31.9	4.9	31.8	5.3	31.9
9	4.9	32.0	4.7	31.9	6.2	32.0
10	5.2	31.8	4.6	31.8	6.3	32.0
11	5.2	31.5	5.0	32.0	6.4	31.8
12	5.6	31.2	4.6	31.9	6.5	31.9
13	5.0	31.6	4.4	32.0	6.9	31.9
14	4.5	32.0	4.7	31.9	7.1	32.0
15	5.5	31.9	4.8	31.8	6.7	31.8
16	5.8	31.4	4.7	31.8	6.8	31.9
17	5.6	31.1	4.6	31.5	6.5	31.5
18	6.1	31.5	5.1	32.0	7.2	32.3
19	5.5	31.8	4.9	31.6	6.8	32.1
20	5.3	31.6	4.0	31.8	6.2	31.9
21	5.7	31.0	4.3	32.0	6.6	32.0
22	5.9	31.2	4.2	31.5	5.9	31.9
23	5.7	31.2	3.8	32.1	5.7	31.6
24	5.3	31.8	3.7	31.9	5.7	32.1
25	5.3	31.5	3.8	31.9	5.7	31.6
26	5.7	31.9	4.2	32.1	5.8	31.9
27	5.9	31.6	4.9	31.8	6.0	31.9
28	5.2	32.0	5.1	31.8	5.8	31.9
29	5.6	31.8			6.2	31.9
30	5.7	32.0			6.7	32.3
31	5.5	32.0			6.6	32.1
MEANS	5.4	31.6	4.7	31.8	6.2	31.9
OBSVNS.	31	31	27	27	31	31
MAXIMUM	6.1	32.0	5.8	32.1	7.2	32.3
MINIMUM	4.5	31.0	3.7	31.2	4.8	31.5
STD.DEV.	.40	.31	.59	.22	.55	.18

LANGARA ISLAND 54 15 19 N 133 03 30 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	6.9	32.0	8.1	31.9	9.7	32.3
2	6.2	31.8	7.9	31.9	10.0	32.3
3	6.7	32.1	8.2	31.9	9.6	32.5
4	* 6.6	* 32.0	8.4	32.1	9.7	32.3
5	6.5	31.9	9.2	32.1	9.6	32.3
6	6.2	32.0	9.0	31.5	9.7	32.0
7	6.1	32.0	8.3	32.1	9.6	32.0
8	7.0	32.3	8.1	31.9	9.3	32.0
9	7.1	32.1	8.1	31.9	9.8	32.0
10	7.0	31.9	8.4	32.0	9.5	32.3
11	7.3	31.9	8.3	32.1	9.7	32.3
12	6.4	31.5	9.4	32.3	9.7	32.3
13	7.3	31.5	9.6	32.0	9.7	32.3
14	7.3	31.5	* 9.8	* 32.1	9.5	32.3
15	7.8	31.8	10.0	32.3	10.3	32.4
16	7.2	32.1	9.4	32.4	10.2	32.0
17	7.2	31.9	10.2	32.7	10.1	32.3
18	7.7	31.8	9.0	32.3	9.7	32.3
19	8.1	31.9	8.4	32.4	* 9.7	* 32.0
20	7.2	31.9	8.8	32.5	9.8	31.6
21	7.8	31.6	9.0	32.3	9.9	32.0
22	7.3	31.6	8.7	32.5	9.9	32.3
23	7.3	31.9	9.3	32.4	11.3	31.9
24	7.2	32.3	8.9	32.3	11.8	32.1
25	7.6	32.0	9.1	32.4	10.8	32.0
26	7.9	31.6	9.3	32.4	11.1	31.9
27	8.9	31.8	9.4	32.3	11.3	31.8
28	8.7	31.9	9.4	32.3	10.3	31.8
29	8.8	31.9	9.5	32.3	11.1	32.1
30	8.6	32.0	9.3	32.1	10.4	31.8
31			9.7	32.5		
MEANS	7.4	31.9	8.9	32.2	10.1	32.1
OBSVNS.	29	29	30	30	29	29
MAXIMUM	8.9	32.3	10.2	32.7	11.8	32.5
MINIMUM	6.1	31.5	7.9	31.5	9.3	31.6
STD.DEV.	.76	.21	.61	.25	.65	.22

LANGARA ISLAND 54 15 19 N 133 03 30 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	10.8	30.7	13.1	31.5	10.0	31.9
2	10.4	31.0	14.0	31.8	12.1	32.1
3	10.0	30.7	13.9	31.8	11.8	31.6
4	11.3	31.4	13.4	31.8	12.8	32.4
5	11.1	30.7	13.5	30.8	13.4	32.3
6	10.3	31.1	13.7	30.8	13.4	31.9
7	10.3	31.1	* 12.8	* 31.4	13.4	32.0
8	11.5	31.0	11.8	32.1	13.4	31.9
9	10.7	31.4	12.2	31.9	14.6	32.0
10	10.5	30.4	12.9	31.8	14.2	32.0
11	11.2	30.7	12.1	32.3	* 14.4	* 32.0
12	11.9	31.2	12.3	32.1	14.6	32.0
13	12.0	31.0	13.1	31.9	15.2	32.3
14	12.7	31.5	12.9	32.0	15.5	32.3
15	13.6	31.8	12.8	31.9	14.5	31.9
16	13.4	31.4	12.2	31.8	14.3	31.0
17	13.3	31.1	12.2	31.5	14.8	32.0
18	12.8	31.1	12.8	32.0	14.2	31.8
19	13.4	32.0	12.8	31.8	14.4	31.2
20	13.3	30.8	12.9	32.0	13.3	31.6
21	13.4	31.5	12.1	31.8	13.4	31.6
22	14.1	31.8	12.8	31.4	13.2	31.8
23	13.9	31.4	12.4	31.5	12.8	31.5
24	14.0	31.0	12.7	31.9	14.1	32.0
25	11.4	30.4	11.8	32.3	13.4	31.9
26	12.7	30.7	11.4	32.0	13.2	31.6
27	12.9	30.7	11.8	32.4	14.1	32.0
28	13.1	31.0	11.2	32.4	13.9	31.9
29	12.7	30.8	12.8	32.3	13.2	32.0
30	12.7	31.1	11.5	32.0	13.9	32.3
31	12.9	30.7	* 10.8	* 32.0		
MEANS	12.2	31.1	12.6	31.8	13.6	31.9
OBSVNS.	31	31	29	29	29	29
MAXIMUM	14.1	32.0	14.0	32.4	15.5	32.4
MINIMUM	10.0	30.4	11.2	30.8	10.0	31.0
STD.DEV.	1.27	.40	.73	.39	1.09	.32

LANGARA ISLAND 54 15 19 N 133 03 30 W

	OCTOBER		NOVEMBER		DECEMBER	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	14.1	32.3	10.6	32.0	7.9	31.9
2	13.4	32.0	9.9	32.0	8.4	31.9
3	13.5	32.3	9.1	32.0	8.2	31.9
4	13.1	32.1	9.9	32.1	8.4	31.8
5	13.2	32.0	9.5	31.9	9.2	32.0
6	12.4	31.9	9.3	32.0	8.4	31.8
7	11.4	32.1	10.0	32.1	8.7	31.9
8	11.3	32.4	9.6	32.0	8.3	31.5
9	13.3	31.8	9.4	30.8	7.8	32.1
10	13.3	31.5	9.8	31.6	8.3	31.8
11	13.8	31.5	9.4	31.5	* 7.7	* 31.6
12	12.5	31.4	9.5	31.9	7.1	31.4
13	12.7	31.4	9.4	32.0	7.9	31.8
14	11.7	31.6	10.2	31.5	3.7	31.2
15	11.2	31.4	9.5	32.0	4.4	31.9
16	11.5	32.0	9.6	32.3	7.2	32.9
17	12.1	32.3	9.4	32.4	8.0	31.9
18	11.1	32.3	8.9	32.0	8.1	32.0
19	11.5	31.8	9.7	32.1	7.9	31.8
20	11.6	31.8	9.5	32.0	8.3	32.0
21	10.6	32.3	9.7	32.1	6.8	31.8
22	10.4	31.8	9.3	31.9	7.3	32.1
23	11.7	32.3	9.2	32.0	7.3	31.6
24	11.5	31.9	9.0	31.8	7.2	32.3
25	11.9	32.3	8.6	32.1	7.5	31.9
26	11.1	31.9	7.8	31.9	7.3	31.6
27	11.2	31.9	7.9	32.1	7.7	32.1
28	11.2	32.0	8.9	32.0	8.3	31.8
29	10.7	31.9	9.5	31.9	7.7	32.0
30	10.7	31.9	8.6	32.1	7.3	32.3
31	10.1	31.5			7.7	32.1
MEANS	11.9	31.9	9.4	31.9	7.6	31.9
OBSVNS.	31	31	30	30	30	30
YRLY.MEANS..					9.2	31.8
MAXIMUM	14.1	32.4	10.6	32.4	9.2	32.9
MINIMUM	10.1	31.4	7.8	30.8	3.7	31.2
STD.DEV.	1.09	.31	.59	.29	1.11	.30

BØNILLA ISLAND 53 29 39 N 130 38 04 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	4.9	30.7	5.4	31.5	5.1	30.8
2	* 5.0	* 30.8	5.6	31.2	* 5.3	* 30.8
3	5.1	31.0	5.6	31.2	5.5	30.8
4	* 5.3	* 30.9	6.1	30.8	6.0	31.0
5	5.6	30.8	5.6	31.1	6.0	31.0
6	5.1	30.7	5.6	31.1	* 5.9	* 31.0
7	5.0	30.8	5.2	31.5	5.8	31.1
8	5.0	31.0	5.3	31.4	5.6	30.8
9	4.6	31.1	5.4	31.2	5.6	31.1
10	5.4	30.7	4.9	31.0	6.0	31.0
11	5.6	31.0	4.7	31.4	6.1	31.0
12	5.6	31.2	4.9	31.5	5.9	31.2
13	4.9	31.5	5.0	31.1	7.0	31.1
14	5.3	31.2	3.5	31.4	6.4	31.0
15	4.6	31.5	4.4	31.5	6.4	31.0
16	5.1	31.1	4.9	31.2	7.2	31.1
17	5.8	30.8	4.6	31.5	* 7.0	* 31.1
18	5.6	31.1	5.3	31.4	6.7	31.1
19	5.7	31.0	5.6	31.5	6.7	31.1
20	5.6	31.1	4.9	30.8	6.3	31.2
21	5.5	31.1	5.1	31.2	6.4	31.2
22	5.9	31.0	4.6	31.4	6.7	31.2
23	6.0	31.1	4.6	31.2	6.4	31.2
24	5.5	31.2	4.4	31.1	6.2	31.2
25	5.5	30.8	5.0	31.2	6.2	31.2
26	5.4	31.1	5.1	31.2	6.3	31.2
27	5.6	31.2	4.9	31.2	6.4	31.1
28	5.4	31.2	5.2	31.1	6.4	31.0
29	5.0	31.2			6.3	31.2
30	5.6	31.4			6.7	31.4
31	5.6	31.4			7.6	31.1
MEANS	5.4	31.1	5.0	31.2	6.3	31.1
ØBSVNS.	29	29	28	28	28	28
MAXIMUM	6.0	31.5	6.1	31.5	7.6	31.4
MINIMUM	4.6	30.7	3.5	30.8	5.1	30.8
STD.DEV.	.36	.23	.51	.20	.53	.14

BONILLA ISLAND 53 29 39 N 130 38 04 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	7.8	30.8	* 9.2	* 31.3	9.9	31.1
2	7.3	31.1	9.3	31.4	10.5	31.1
3	7.2	31.1	8.1	31.2	9.9	31.0
4	7.3	30.8	7.9	31.0	9.6	31.0
5	6.4	30.7	8.2	30.8	9.9	30.7
6	6.1	30.6	8.1	31.0	10.6	31.0
7	6.3	30.7	8.4	31.2	11.1	31.0
8	6.7	31.2	8.3	31.0	10.4	31.1
9	7.1	30.8	8.4	31.4	10.6	30.6
10	7.7	31.0	8.8	31.0	10.6	31.0
11	7.5	30.8	9.1	31.4	11.2	30.8
12	6.8	31.0	10.4	31.0	11.8	30.8
13	7.7	30.8	10.1	31.4	12.7	31.1
14	8.2	31.0	10.0	31.1	11.6	30.8
15	* 7.8	* 31.0	10.4	31.2	11.6	30.6
16	7.3	31.1	9.1	31.2	11.2	30.8
17	7.2	31.1	9.9	31.4	11.7	31.0
18	8.3	31.1	8.5	31.5	11.2	30.6
19	8.4	31.4	8.9	31.1	11.0	31.0
20	7.1	31.5	9.0	31.4	11.1	30.8
21	7.2	31.1	9.3	31.2	11.4	31.1
22	7.8	31.0	9.4	31.1	11.1	31.1
23	7.8	31.1	9.6	31.0	11.1	30.7
24	7.3	31.1	9.4	30.7	12.2	31.0
25	7.8	31.0	* 9.5	* 30.8	* 12.2	* 31.0
26	8.4	31.0	9.6	31.0	12.3	31.0
27	8.8	31.4	11.2	31.1	12.2	31.0
28	* 9.2	* 31.2	9.8	31.2	12.3	31.0
29	9.6	31.0	9.9	31.1	10.7	30.4
30	9.2	31.2	9.6	31.0	11.9	30.7
31			10.0	30.6		
MEANS	7.6	31.0	9.3	31.1	11.2	30.9
OBSVNS.	28	28	29	29	29	29
MAXIMUM	9.6	31.5	11.2	31.5	12.7	31.1
MINIMUM	6.1	30.6	7.9	30.6	9.6	30.4
STD.DEV.	.83	.22	.82	.22	.81	.19

BONILLA ISLAND 53 29 39 N 130 38 04 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	11.2	30.8	13.4	31.1	11.1	31.1
2	11.0	30.8	12.7	30.7	* 11.2	* 31.3
3	10.7	31.1	13.4	30.8	11.3	31.6
4	11.1	30.6	12.9	30.7	11.3	31.0
5	11.2	30.6	12.2	30.6	12.2	31.0
6	11.9	30.7	13.4	30.7	11.9	30.6
7	11.3	30.8	12.4	31.0	12.7	30.8
8	12.2	30.6	11.7	30.8	* 12.6	* 30.8
9	11.9	30.6	11.1	31.1	12.5	30.8
10	12.6	31.0	11.5	31.2	12.8	30.7
11	13.0	30.8	11.6	31.1	12.8	31.0
12	10.9	30.6	11.1	31.2	13.3	31.1
13	12.7	31.0	10.6	31.2	13.6	31.0
14	* 12.7	* 31.1	11.6	31.0	14.4	30.7
15	12.7	31.2	11.7	30.7	13.3	30.7
16	13.2	31.1	11.4	30.8	* 13.3	* 30.7
17	13.9	30.8	12.9	30.6	13.3	30.8
18	12.9	30.4	13.3	30.6	13.3	30.8
19	11.9	30.8	11.6	31.1	13.1	30.6
20	12.2	31.0	11.6	31.0	12.7	30.7
21	12.1	31.0	11.2	31.4	* 13.0	* 30.7
22	12.6	31.1	12.0	31.4	13.3	30.8
23	12.7	31.0	13.9	31.0	12.8	31.0
24	12.4	31.1	12.3	30.7	12.8	31.2
25	12.2	31.2	13.1	30.6	13.1	31.0
26	12.2	31.1	11.5	30.7	* 13.0	* 30.9
27	11.6	31.1	11.6	30.6	12.9	30.7
28	11.8	31.0	12.3	30.7	12.8	30.7
29	11.8	31.1	12.8	30.7	12.4	30.4
30	11.2	31.2	12.8	30.4	12.8	30.4
31	12.2	31.2	12.2	30.4		
MEANS	12.0	30.9	12.2	30.9	12.7	30.8
OBSVNS.	30	30	31	31	25	25
MAXIMUM	13.9	31.2	13.9	31.4	14.4	31.6
MINIMUM	10.7	30.4	10.6	30.4	11.1	30.4
STD.DEV.	.76	.23	.84	.27	.75	.26

BONILLA ISLAND 53 29 39 N 130 38 04 W

	OCTOBER		NOVEMBER		DECEMBER	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	12.5	31.0	10.2	30.4	9.4	30.8
2	12.7	31.2	* 10.3	* 30.5	8.4	31.1
3	12.6	30.4	10.4	30.7	8.4	31.4
4	12.7	30.7	10.5	30.7	8.4	30.8
5	12.4	30.8	10.6	30.6	8.9	30.4
6	12.3	31.2	10.3	30.4	8.6	31.1
7	12.4	31.0	10.1	30.6	8.6	30.6
8	12.3	30.8	10.1	30.8	8.4	30.8
9	12.5	31.0	10.1	31.0	8.3	31.1
10	12.6	30.8	9.9	31.0	8.3	31.0
11	12.7	30.4	10.1	30.8	* 8.3	* 31.0
12	12.6	30.7	9.9	31.1	8.3	31.1
13	12.2	30.8	9.6	31.1	8.1	30.8
14	11.7	30.8	9.7	30.4	* 7.7	* 30.8
15	11.6	30.8	9.9	30.7	7.3	30.8
16	11.7	30.8	9.9	30.2	6.7	31.0
17	11.8	30.6	9.6	30.6	7.8	30.8
18	11.2	30.4	9.3	31.1	8.4	31.1
19	11.6	30.7	9.4	31.6	8.3	31.1
20	11.7	30.6	9.7	30.6	8.4	31.4
21	10.7	30.4	* 9.8	* 30.7	7.8	31.0
22	* 10.9	* 30.4	9.9	30.8	7.7	30.3
23	11.1	30.4	8.9	31.0	8.2	30.3
24	11.1	30.6	8.8	31.1	7.8	30.8
25	11.4	30.4	9.4	31.0	7.8	30.2
26	11.1	30.4	9.0	31.0	8.3	30.3
27	10.4	30.7	8.7	31.1	* 8.3	* 30.4
28	10.8	30.7	8.9	31.1	8.4	30.6
29	10.6	30.6	9.3	31.4	8.3	30.3
30	10.1	30.3	* 9.3	* 31.1	9.3	31.1
31	10.0	30.6			8.3	31.1
MEANS	11.7	30.7	9.7	30.8	8.2	30.8
OBSVNS.	30	30	27	27	28	28
YRLY.MEANS..					9.3	31.0
MAXIMUM	12.7	31.2	10.6	31.6	9.4	31.4
MINIMUM	10.0	30.3	8.7	30.2	6.7	30.2
STD.DEV.	.84	.24	.54	.32	.53	.34

CAPE ST JAMES 51 56 18 N 131 00 50 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	7.4	*	6.6	*	6.3	*
2	7.2	*	6.6	*	6.4	*
3	6.9	*	6.5	*	6.4	*
4	6.9	*	* 6.5	*	6.7	*
5	6.9	*	6.6	*	6.7	*
6	6.5	*	6.5	*	6.8	*
7	6.3	*	6.2	*	6.6	*
8	6.1	*	6.6	*	6.8	*
9	6.7	*	6.2	*	6.8	*
10	7.1	*	6.4	*	6.8	*
11	6.8	*	6.3	*	7.1	*
12	6.8	*	6.2	*	7.1	*
13	6.4	*	6.1	*	7.1	*
14	6.6	*	6.2	*	7.2	*
15	6.8	*	6.3	*	7.1	*
16	6.9	*	6.4	*	7.2	*
17	6.9	*	6.4	*	7.1	*
18	6.7	*	6.3	*	7.4	*
19	6.3	*	6.3	*	7.3	*
20	6.4	*	6.1	*	7.2	*
21	6.4	*	6.1	*	7.0	*
22	6.4	*	6.0	*	7.1	*
23	6.4	*	5.7	*	7.1	*
24	6.3	*	5.7	*	7.2	*
25	* 6.4	*	6.1	*	7.3	*
26	6.6	*	6.0	*	6.9	*
27	6.6	*	6.3	*	7.2	*
28	6.4	*	6.4	*	7.2	*
29	6.4	*			7.3	*
30	6.4	*			7.2	*
31	6.5	*			7.4	*
MEANS	6.6	0.0	6.3	0.0	7.0	0.0
OBSVNS.	30	0	27	0	31	0
MAXIMUM	7.4	0.0	6.6	0.0	7.4	0.0
MINIMUM	6.1	0.0	5.7	0.0	6.3	0.0
STD.DEV.	.30	0.00	.24	0.00	.30	0.00

CAPE ST JAMES 51 56 18 N 131 00 50 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	7.5	*	8.3	*	9.1	*
2	7.4	*	8.2	*	8.8	*
3	7.2	*	8.2	*	8.9	*
4	7.5	*	8.2	*	8.7	*
5	7.3	*	8.1	*	8.6	*
6	7.4	*	8.2	*	8.8	*
7	7.6	*	8.4	*	8.8	*
8	7.6	*	8.4	*	9.3	*
9	7.4	*	8.4	*	9.2	*
10	7.5	*	8.4	*	9.9	*
11	7.5	*	8.4	*	9.9	*
12	7.2	*	8.7	*	9.2	*
13	7.4	*	8.6	*	9.8	*
14	7.5	*	8.9	*	9.5	*
15	7.7	*	9.3	*	9.6	*
16	7.7	*	9.1	*	9.6	*
17	7.7	*	9.0	*	9.4	*
18	7.7	*	8.6	*	9.6	*
19	7.9	*	8.7	*	9.7	*
20	7.9	*	8.6	*	9.8	*
21	7.8	*	8.7	*	9.9	*
22	7.8	*	8.4	*	10.4	*
23	8.2	*	8.9	*	10.2	*
24	8.1	*	9.1	*	10.7	*
25	8.1	*	8.4	*	10.1	*
26	8.1	*	8.7	*	10.6	*
27	8.2	*	8.8	*	10.1	*
28	8.3	*	8.9	*	10.6	*
29	8.3	*	9.3	*	10.4	*
30	8.2	*	9.2	*	10.3	*
31			9.6	*		
MEANS	7.7	0.0	8.7	0.0	9.6	0.0
OBSVNS.	30	0	31	0	30	0
MAXIMUM	8.3	0.0	9.6	0.0	10.7	0.0
MINIMUM	7.2	0.0	8.1	0.0	8.6	0.0
STD.DEV.	.34	0.00	.39	0.00	.62	0.00

CAPE ST JAMES 51 56 18 N 131 00 50 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	10.1	*	12.1	*	13.7	*
2	10.6	*	12.3	*	14.3	*
3	10.6	*	11.7	*	12.6	*
4	10.9	*	12.7	*	12.3	*
5	10.8	*	12.6	*	12.1	*
6	11.6	*	12.6	*	11.9	*
7	11.6	*	12.7	*	11.9	*
8	10.9	*	12.9	*	11.3	*
9	10.6	*	12.8	*	11.0	*
10	10.4	*	12.9	*	11.1	*
11	11.1	*	12.4	*	10.9	*
12	11.0	*	12.8	*	10.9	*
13	11.7	*	12.4	*	11.1	*
14	10.7	*	12.6	*	11.4	*
15	11.5	*	12.7	*	11.7	*
16	10.9	*	13.2	*	11.5	*
17	11.9	*	13.7	*	11.0	*
18	11.2	*	13.5	*	11.1	*
19	11.6	*	13.4	*	11.0	*
20	11.3	*	14.3	*	11.3	*
21	11.4	*	14.1	*	11.3	*
22	11.3	*	14.9	*	12.3	*
23	11.2	*	14.6	*	11.4	*
24	11.1	*	14.5	*	11.3	*
25	11.2	*	14.0	*	11.8	*
26	12.1	*	13.6	*	11.4	*
27	12.3	*	13.8	*	11.4	*
28	12.1	*	13.7	*	11.4	*
29	12.7	*	13.7	*	10.9	*
30	12.8	*	14.7	*	11.1	*
31	12.6	*	14.4	*		
MEANS	11.3	0.0	13.3	0.0	11.6	0.0
OBSVNS.	31	0	31	0	30	0
MAXIMUM	12.8	0.0	14.9	0.0	14.3	0.0
MINIMUM	10.1	0.0	11.7	0.0	10.9	0.0
STD.DEV.	.68	0.00	.85	0.00	.79	0.00

CAPE ST JAMES 51 56 18 N 131 00 50 W

	OCTOBER		NOVEMBER		DECEMBER	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	10.4	*	10.6	*	9.3	*
2	11.0	*	10.7	*	9.2	*
3	10.7	*	10.7	*	9.3	*
4	10.4	*	10.7	*	9.4	*
5	10.2	*	10.7	*	9.5	*
6	10.3	*	10.5	*	9.4	*
7	10.7	*	10.4	*	9.6	*
8	10.8	*	10.7	*	9.1	*
9	11.0	*	10.6	*	9.7	*
10	10.4	*	10.6	*	9.4	*
11	10.8	*	10.4	*	9.1	*
12	10.6	*	10.2	*	9.1	*
13	11.2	*	10.0	*	8.9	*
14	11.6	*	10.3	*	9.0	*
15	11.4	*	10.1	*	8.7	*
16	11.4	*	10.4	*	9.3	*
17	11.2	*	9.8	*	9.3	*
18	10.6	*	9.7	*	9.4	*
19	10.8	*	10.0	*	9.1	*
20	10.5	*	* 9.6	*	9.1	*
21	10.8	*	* 9.2	*	8.7	*
22	* 10.4	*	8.8	*	8.8	*
23	9.9	*	9.2	*	* 8.8	*
24	10.5	*	9.3	*	8.9	*
25	* 10.3	*	9.4	*	9.0	*
26	10.0	*	9.3	*	9.2	*
27	9.8	*	9.4	*	9.2	*
28	10.3	*	9.5	*	9.1	*
29	10.9	*	* 9.5	*	8.9	*
30	10.3	*	9.4	*	9.1	*
31	10.7	*			9.2	*
MEANS	10.7	0.0	10.1	0.0	9.2	0.0
OBSVNS.	29	0	27	0	30	0
YRLY.MEANS..					9.4	
MAXIMUM	11.6	0.0	10.7	0.0	9.7	0.0
MINIMUM	9.8	0.0	8.8	0.0	8.7	0.0
STD.DEV.	.45	0.00	.58	0.00	.25	0.00

MCINNES ISLAND 52 15 48 N 128 43 10 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	6.2	30.7	5.2	31.9	5.6	32.3
2	6.0	31.0	5.2	31.9	5.4	31.9
3	6.2	31.1	5.8	32.3	5.9	32.1
4	6.2	31.1	5.6	32.3	6.0	32.3
5	6.2	31.1	6.4	32.3	6.3	32.3
6	5.8	31.2	6.4	32.3	6.6	32.5
7	6.0	31.2	6.3	32.4	6.1	31.8
8	6.3	31.5	5.9	32.3	6.2	31.8
9	6.3	31.4	6.1	32.3	6.3	32.0
10	5.8	31.4	5.9	32.3	6.3	31.4
11	5.9	31.5	5.6	32.3	6.0	30.0
12	5.8	31.6	5.6	32.3	6.2	30.2
13	5.8	31.6	5.1	31.6	5.9	30.0
14	6.2	31.8	5.0	32.1	5.9	31.2
15	5.2	31.5	5.2	31.9	6.3	31.2
16	5.6	31.6	5.4	31.5	6.2	30.7
17	5.7	31.6	5.3	31.6	5.8	30.2
18	5.9	31.8	* 5.5	* 31.8	6.4	31.4
19	6.1	32.1	5.8	32.0	6.7	30.3
20	6.3	32.3	5.7	31.9	6.8	31.4
21	5.9	32.0	5.3	31.9	7.2	30.7
22	6.0	32.3	5.2	31.9	7.2	31.1
23	6.4	32.5	5.1	31.9	6.9	31.6
24	6.2	32.3	5.0	31.6	7.0	31.5
25	5.7	32.3	5.3	32.0	6.8	31.2
26	6.3	32.3	5.3	32.0	7.1	31.6
27	6.1	32.3	5.9	32.3	6.7	31.6
28	5.4	31.6	5.6	32.3	6.6	31.6
29	5.6	32.0			6.7	31.6
30	5.6	32.0			6.8	31.9
31	5.6	32.3			6.6	31.9
MEANS	5.9	31.7	5.6	32.1	6.4	31.4
OBSVNS.	31	31	27	27	31	31
MAXIMUM	6.4	32.5	6.4	32.4	7.2	32.5
MINIMUM	5.2	30.7	5.0	31.5	5.4	30.0
STD.DEV.	.30	.48	.42	.27	.47	.71

MCINNES ISLAND 52 15 48 N 128 43 10 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	6.6	31.9	9.1	31.6	11.1	31.5
2	7.0	31.6	8.9	31.6	10.8	31.2
3	6.8	31.6	9.0	31.6	10.7	31.5
4	7.7	31.5	9.0	31.8	10.7	31.5
5	7.5	31.6	9.0	31.5	10.7	31.5
6	7.5	31.6	9.6	31.0	11.1	31.5
7	6.9	31.5	9.7	31.1	11.3	31.2
8	7.1	31.9	9.6	31.1	11.3	31.0
9	7.2	31.9	9.6	31.1	11.1	30.4
10	8.1	31.8	9.6	31.1	11.2	30.4
11	7.2	31.4	9.0	32.1	11.4	29.5
12	7.2	31.4	9.2	31.6	11.7	29.5
13	7.1	31.4	9.9	31.6	11.6	30.6
14	7.2	31.4	10.0	31.9	11.7	30.6
15	7.7	31.0	9.9	31.9	11.3	30.6
16	8.1	31.2	9.9	31.6	11.4	30.6
17	8.0	31.5	9.9	31.4	10.9	30.7
18	7.7	31.8	10.3	31.6	11.1	30.4
19	8.1	31.5	10.1	32.0	11.7	30.6
20	8.6	31.1	9.9	31.9	11.8	31.0
21	8.4	31.5	10.3	31.6	11.7	31.4
22	8.4	31.5	10.2	31.6	10.8	31.5
23	9.4	30.8	10.6	31.8	11.1	31.8
24	9.8	30.7	10.7	31.8	11.2	31.5
25	9.4	30.7	10.6	31.8	11.6	31.1
26	9.0	30.8	10.7	31.8	11.7	30.8
27	9.3	30.8	10.8	31.8	11.9	30.7
28	9.2	30.7	10.8	31.5	12.7	30.7
29	9.9	31.2	10.8	31.5	12.4	30.7
30	9.7	31.0	10.8	31.5	12.0	31.0
31			11.2	31.5		
MEANS	8.1	31.3	10.0	31.6	11.4	30.9
OBSVNS.	30	30	31	31	30	30
MAXIMUM	9.9	31.9	11.2	32.1	12.7	31.8
MINIMUM	6.6	30.7	8.9	31.0	10.7	29.5
STD.DEV.	1.00	.38	.67	.28	.49	.56

MCINNES ISLAND 52 15 48 N 128 43 10 W

DATE	JULY TEMP	JULY SAL	AUGUST TEMP	AUGUST SAL	SEPTEMBER 1979 TEMP	SEPTEMBER 1979 SAL
1	13.0	31.1	14.0	31.4	14.8	31.9
2	11.2	31.0	13.8	31.4	14.9	31.9
3	11.1	30.7	13.9	31.1	14.7	31.8
4	11.4	30.6	14.2	30.8	14.6	31.8
5	13.2	30.3	14.6	32.0	14.4	31.8
6	13.9	28.5	14.8	31.8	14.1	31.6
7	14.0	29.8	14.6	31.8	14.1	31.5
8	13.2	30.2	13.6	31.6	14.1	31.4
9	14.7	29.0	13.6	31.2	13.9	31.5
10	13.7	29.7	13.6	31.0	13.9	31.6
11	13.0	30.8	*	*	14.2	31.1
12	13.6	30.2	*	*	14.2	31.1
13	13.9	30.6	*	*	14.3	31.2
14	14.3	31.0	*	*	14.4	31.5
15	14.1	30.8	*	*	14.6	31.8
16	14.2	31.1	*	*	14.3	31.5
17	14.7	31.2	*	*	* 14.2	* 31.3
18	15.4	31.5	*	*	14.1	31.1
19	15.8	31.0	*	*	14.0	30.8
20	14.6	31.4	15.3	31.5	14.0	30.3
21	13.2	31.2	15.3	32.0	13.9	31.1
22	13.7	31.2	15.3	32.0	14.0	30.0
23	13.3	31.2	15.3	31.8	14.0	30.3
24	13.1	30.8	15.3	31.8	13.9	31.1
25	13.3	31.2	14.7	31.8	14.0	31.1
26	13.3	31.0	13.9	31.6	13.9	31.4
27	13.4	31.1	13.7	31.5	13.9	31.4
28	13.1	31.2	13.3	31.5	13.9	31.5
29	13.0	31.1	13.8	31.6	13.2	31.5
30	13.3	31.2	13.9	31.6	13.0	31.5
31	13.9	31.6	14.8	31.9		
MEANS	13.5	30.8	14.3	31.6	14.1	31.3
OBSVNS.	31	31	22	22	29	29
MAXIMUM	15.8	31.6	15.3	32.0	14.9	31.9
MINIMUM	11.1	28.5	13.3	30.8	13.0	30.0
STD.DEV.	1.04	.70	.68	.33	.41	.48

MCINNES ISLAND 52 15 48 N 128 43 10 W

	OCTOBER		NOVEMBER		DECEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	13.7	32.3	10.2	30.3	8.4	31.2
2	13.0	31.5	10.2	30.3	8.0	31.0
3	13.1	30.0	10.2	30.3	8.6	31.4
4	13.3	29.0	10.0	30.3	8.4	31.0
5	13.1	30.4	9.8	30.6	8.4	30.7
6	13.1	30.6	9.8	30.8	8.2	30.3
7	12.9	30.8	10.0	30.8	8.4	30.7
8	12.9	31.1	9.8	31.1	8.8	30.8
9	12.9	31.1	10.0	31.1	8.3	31.2
10	12.9	31.1	9.7	31.8	8.2	31.2
11	13.0	31.2	9.6	31.8	8.2	31.2
12	12.9	31.2	9.9	31.6	7.9	31.0
13	12.8	31.4	9.8	31.6	7.6	31.0
14	12.6	30.4	9.9	31.6	7.2	31.1
15	12.2	30.2	9.9	31.4	6.9	30.8
16	12.0	30.7	9.7	31.2	6.8	30.0
17	11.3	31.1	9.5	31.5	7.0	30.0
18	11.4	30.6	8.8	31.4	7.7	30.2
19	11.2	31.2	9.3	31.5	7.8	30.4
20	11.1	31.0	9.6	31.5	7.7	30.6
21	11.2	30.7	9.9	31.9	8.4	31.2
22	11.3	31.1	9.4	31.8	7.8	31.0
23	11.8	32.0	9.3	31.8	7.6	31.0
24	11.3	30.8	9.2	31.6	7.7	31.0
25	11.4	31.1	8.7	31.4	8.3	31.0
26	11.4	31.4	5.7	30.4	8.6	31.4
27	11.3	31.4	7.9	30.4	8.8	31.4
28	11.3	31.4	7.8	30.3	8.6	31.1
29	11.2	31.2	7.6	30.2	8.0	30.7
30	11.2	31.2	7.6	30.2	7.7	30.4
31	10.3	30.6			7.8	30.3
MEANS	12.1	31.0	9.3	31.1	8.0	30.8
OBSVNS.	31	31	30	30	31	31
YRLY.MEANS..					9.8	31.3
MAXIMUM	13.7	32.3	10.2	31.9	8.8	31.4
MINIMUM	10.3	29.0	5.7	30.2	6.8	30.0
STD.DEV.	.91	.60	1.02	.60	.53	.40

EGG ISLAND 51 15 06 N 127 49 53 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	5•5	32•0	5•6	31•9	6•2	31•8
2	6•2	31•8	5•6	32•0	6•4	31•8
3	6•2	32•0	6•1	32•0	6•6	32•1
4	6•1	31•9	6•1	31•6	6•8	32•1
5	5•6	31•9	6•2	31•4	6•7	31•6
6	5•5	32•0	6•2	32•1	6•7	31•4
7	5•5	32•0	5•9	32•0	6•4	31•4
8	5•1	31•9	6•1	31•9	6•1	31•2
9	5•5	31•6	5•8	31•8	6•2	31•6
10	6•2	32•0	5•8	31•8	6•9	31•5
11	6•4	32•1	6•1	32•0	6•9	31•4
12	6•1	32•0	5•6	31•5	6•6	31•1
13	6•2	31•9	4•3	31•9	7•2	31•6
14	6•2	31•5	5•6	31•8	6•9	31•4
15	5•7	31•8	5•7	32•0	7•0	30•8
16	6•2	32•0	6•2	31•9	6•7	31•5
17	6•7	31•4	6•2	31•9	6•8	31•4
18	6•2	32•1	6•1	32•0	7•8	31•5
19	6•4	31•8	6•0	31•8	7•4	31•1
20	6•2	31•8	5•8	31•8	7•6	31•0
21	6•1	31•8	5•1	31•9	8•3	31•0
22	* 6•2	* 31•8	5•4	31•4	7•0	31•1
23	6•4	31•9	4•9	31•6	6•8	31•1
24	6•0	32•0	5•8	31•2	7•2	31•2
25	5•7	32•0	6•1	31•5	7•6	30•8
26	6•1	31•5	5•7	31•8	7•3	31•0
27	6•0	32•3	6•2	31•8	7•3	30•8
28	5•6	31•6	6•1	31•6	7•3	31•0
29	5•7	31•8			7•8	31•0
30	5•7	31•8			* 7•8	* 31•0
31	5•6	32•0			7•8	31•1
MEANS	6•0	31•9	5•8	31•8	7•0	31•3
OBSVNS•	30	30	28	28	30	30
MAXIMUM	6•7	32•3	6•2	32•1	8•3	32•1
MINIMUM	5•1	31•4	4•3	31•2	6•1	30•8
STD•DEV•	•37	•20	•45	•22	•54	•35

EGG ISLAND 51 15 06 N 127 49 53 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	7.3	31.1	9.4	31.4	13.6	27.4
2	7.5	31.1	9.5	31.2	12.7	27.4
3	7.2	30.8	10.1	30.0	12.9	24.2
4	7.4	31.1	9.9	30.2	* 11.5	* 26.8
5	* 7.3	* 30.7	9.3	31.0	10.0	29.5
6	7.2	30.3	9.3	31.1	11.2	30.0
7	6.9	30.8	9.2	31.2	10.9	29.1
8	7.3	31.6	8.9	31.0	12.2	27.2
9	7.3	31.1	10.2	30.8	12.8	26.0
10	7.7	30.7	9.5	31.2	* 12.3	* 26.3
11	7.7	31.2	9.7	31.5	11.7	26.7
12	7.3	31.2	9.9	31.4	12.3	28.0
13	7.9	31.0	10.1	31.4	13.9	27.6
14	7.9	31.0	10.5	31.1	13.3	28.1
15	8.1	31.2	10.1	30.2	11.3	27.2
16	8.3	30.7	11.4	29.3	13.2	25.1
17	8.8	30.8	11.1	29.3	11.8	27.6
18	9.4	29.7	10.7	30.0	11.1	29.0
19	9.0	30.3	9.5	* 28.7	10.6	29.7
20	8.2	30.4	11.6	27.4	11.6	27.8
21	8.1	30.4	11.0	29.0	13.8	26.4
22	8.4	31.0	11.7	28.8	12.8	27.7
23	9.9	31.1	11.1	30.0	13.4	28.6
24	9.4	31.1	11.1	28.8	14.6	25.9
25	9.4	31.2	10.7	29.0	13.8	29.7
26	8.9	31.2	12.2	28.0	14.0	26.1
27	10.5	31.1	11.7	29.9	14.4	27.1
28	11.2	30.8	10.9	30.2	14.6	28.4
29	11.1	30.8	12.1	27.1	11.9	30.4
30	9.2	31.2	12.9	26.4	12.9	29.0
31			12.9	27.4		
MEANS	8.4	30.9	10.6	29.8	12.6	27.7
OBSVNS.	29	29	31	30	28	28
MAXIMUM	11.2	31.6	12.9	31.5	14.6	30.4
MINIMUM	6.9	29.7	8.9	26.4	10.0	24.2
STD.DEV.	1.19	.38	1.10	1.46	1.27	1.52

EGG ISLAND 51 15 06 N 127 49 53 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	12.8	30.3	13.5	27.7	12.6	31.0
2	10.2	30.4	12.4	28.2	13.4	31.5
3	11.2	29.8	12.3	28.0	13.2	31.5
4	12.7	28.2	13.4	27.1	11.2	31.2
5	13.8	26.0	13.8	26.0	11.7	31.4
6	13.8	26.5	14.4	27.2	13.5	31.8
7	14.9	24.6	* 13.6	* 28.3	13.7	31.5
8	13.3	29.1	12.8	29.5	14.3	31.9
9	12.2	30.6	12.8	30.2	13.9	32.0
10	11.8	30.6	13.1	29.7	14.2	31.8
11	10.6	30.4	16.7	28.8	14.4	31.1
12	10.5	30.8	12.8	30.7	13.9	31.9
13	10.4	31.2	13.6	30.4	14.0	32.1
14	11.4	31.0	15.6	29.4	14.2	31.6
15	11.4	31.0	14.6	30.2	* 13.9	* 31.3
16	13.2	31.0	14.6	28.9	13.6	31.0
17	12.7	30.7	13.4	29.9	13.6	29.8
18	12.2	30.7	13.2	30.3	13.6	31.0
19	12.7	29.8	11.6	31.6	13.3	30.7
20	13.3	29.4	11.5	31.5	12.9	31.0
21	11.8	30.6	14.3	31.0	13.3	30.4
22	11.6	30.7	11.8	31.0	12.8	31.5
23	12.3	29.9	13.3	31.4	12.8	30.3
24	14.3	30.2	12.8	31.1	13.0	30.6
25	12.8	28.6	13.0	30.8	12.8	30.3
26	13.7	29.0	11.3	31.5	12.7	31.4
27	* 14.4	* 27.7	11.8	31.4	12.7	31.4
28	15.1	26.4	13.2	30.7	12.3	31.1
29	14.0	29.5	12.7	31.6	11.1	31.4
30	13.9	29.0	11.1	31.5	11.2	31.4
31	13.3	29.0	11.7	31.4		
MEANS	12.6	29.5	13.1	30.0	13.1	31.2
OBSVNS.	30	30	30	30	29	29
MAXIMUM	15.1	31.2	16.7	31.6	14.4	32.1
MINIMUM	10.2	24.6	11.1	26.0	11.1	29.8
STD.DEV.	1.32	1.67	1.27	1.56	.92	.56

EGG ISLAND 51 15 06 N 127 49 53 W

	OCTOBER		NOVEMBER		DECEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	10.7	30.7	9.7	32.0	9.4	31.8
2	10.3	31.1	9.7	31.6	9.4	32.0
3	10.4	31.6	9.9	31.6	9.4	32.1
4	10.8	28.4	9.9	31.8	9.6	31.9
5	10.8	30.3	10.0	31.8	9.6	31.9
6	10.4	31.5	9.9	31.8	9.4	31.9
7	10.7	31.1	* 9.8	* 31.8	9.4	32.0
8	10.9	30.8	9.7	31.9	9.4	31.8
9	10.8	30.7	9.8	31.9	9.0	32.0
10	10.9	30.3	9.3	31.8	8.9	31.9
11	10.9	30.2	9.3	31.8	8.9	31.6
12	10.8	29.1	9.0	31.8	8.8	31.5
13	10.6	31.2	9.2	31.8	8.9	31.5
14	10.3	31.4	9.4	31.6	8.1	30.8
15	10.2	30.6	* 9.4	* 31.7	* 8.1	* 31.0
16	10.4	31.2	9.4	31.9	8.2	31.2
17	10.2	30.8	9.4	32.1	8.9	31.1
18	9.8	31.5	9.1	32.0	8.9	31.4
19	9.9	31.5	9.0	31.6	9.1	31.2
20	9.7	31.4	9.5	31.5	8.9	31.8
21	9.7	31.4	9.4	32.1	8.8	32.0
22	10.0	31.8	9.5	31.9	8.6	31.9
23	10.2	32.1	9.4	32.0	8.3	31.8
24	10.0	31.8	9.4	32.3	8.6	31.8
25	10.1	32.4	9.3	31.8	8.7	31.6
26	10.3	32.3	8.9	31.8	8.4	31.8
27	10.1	32.0	8.6	31.8	8.5	31.5
28	10.0	31.6	9.1	32.0	8.5	31.1
29	10.0	31.8	8.9	31.8	8.3	31.1
30	9.8	31.6	9.1	31.9	8.1	31.2
31	9.8	31.9			8.2	31.4
MEANS	10.3	31.2	9.4	31.8	8.8	31.6
OBSVNS.	31	31	28	28	30	30
YRLY.MEANS...					9.8	30.7
MAXIMUM	10.9	32.4	10.0	32.3	9.6	32.1
MINIMUM	9.7	28.4	8.6	31.5	8.1	30.8
STD.DEV.	.39	.87	.35	.18	.46	.35

PINE ISLAND 50 56 33 N 127 43 35 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	6.8	31.8	7.0	31.2	6.8	31.0
2	7.1	31.5	7.0	31.2	6.7	31.2
3	7.2	31.5	6.8	31.4	6.8	31.1
4	7.1	31.6	6.9	31.1	7.0	31.2
5	7.0	31.5	6.9	31.0	7.2	30.8
6	7.0	31.2	6.8	31.5	7.0	31.5
7	6.9	31.2	6.8	31.5	6.8	31.0
8	6.6	31.4	6.3	31.4	7.0	31.0
9	6.8	31.5	6.6	31.2	6.8	31.1
10	7.0	31.5	6.8	31.5	7.0	31.0
11	7.1	31.0	6.8	31.5	7.0	31.0
12	7.0	31.6	6.5	31.1	7.0	31.1
13	7.0	31.2	6.0	30.7	7.0	31.1
14	7.0	31.8	6.2	31.4	7.1	31.1
15	7.0	31.6	6.2	31.4	7.3	30.8
16	6.8	31.2	6.7	31.4	7.5	30.7
17	7.1	31.2	6.8	31.5	7.6	30.4
18	7.0	31.1	6.7	31.2	7.2	30.6
19	7.0	31.5	6.8	31.0	7.3	30.7
20	6.9	31.8	6.6	31.6	7.0	31.0
21	7.0	31.4	6.5	31.5	7.3	30.8
22	7.1	31.1	6.3	31.4	7.0	31.1
23	7.0	31.8	6.2	31.5	7.2	31.0
24	7.1	31.5	6.2	31.4	6.8	30.8
25	7.0	31.9	6.5	31.2	6.8	30.7
26	6.9	31.5	6.6	31.1	7.0	30.7
27	7.0	31.5	6.5	31.1	7.0	31.0
28	6.8	31.5	6.9	31.1	7.0	31.1
29	6.8	31.9			7.1	31.1
30	6.9	31.5			7.0	31.0
31	7.2	31.5			7.0	31.1
MEANS	7.0	31.5	6.6	31.3	7.0	31.0
OBSVNS.	31	31	28	28	31	31
MAXIMUM	7.2	31.9	7.0	31.6	7.6	31.5
MINIMUM	6.6	31.0	6.0	30.7	6.7	30.4
STD.DEV.	.13	.24	.26	.21	.21	.22

PINE ISLAND 50 58 33 N 127 43 35 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	7.0	30.8	8.2	31.6	9.2	31.8
2	7.2	31.0	8.1	31.6	9.5	31.8
3	6.8	31.2	8.1	32.9	8.8	32.1
4	7.0	31.1	7.8	32.5	8.9	32.0
5	7.0	30.7	7.5	32.8	8.8	31.4
6	6.8	31.2	7.8	31.9	8.8	31.9
7	6.8	31.0	8.1	31.6	8.9	32.4
8	6.8	31.0	8.2	31.6	8.9	31.9
9	7.0	31.0	8.2	31.5	9.0	32.0
10	7.1	31.0	8.1	31.6	9.1	31.9
11	7.0	31.0	8.4	31.6	8.9	31.2
12	* 7.2	* 31.0	8.2	31.5	8.8	31.9
13	7.4	31.0	8.2	31.5	9.0	32.0
14	7.7	31.4	8.5	31.5	8.9	32.0
15	7.9	31.1	8.2	31.4	8.8	32.0
16	7.9	31.4	8.2	31.9	8.8	32.8
17	7.5	31.2	8.2	31.6	9.0	32.3
18	7.3	31.5	8.4	31.8	8.6	32.4
19	7.6	31.0	8.2	31.5	8.8	31.9
20	7.6	31.0	7.9	31.8	9.1	31.9
21	7.0	31.9	8.1	31.5	9.8	32.7
22	7.1	31.4	* 8.1	* 31.5	9.1	32.0
23	7.5	31.2	8.2	31.5	9.1	31.5
24	7.8	31.2	8.2	31.9	9.2	31.8
25	7.7	31.1	8.1	31.8	9.2	32.1
26	8.2	31.4	8.2	31.8	8.9	31.9
27	9.1	32.0	8.2	32.5	9.5	32.3
28	8.9	32.3	8.7	32.5	9.9	32.0
29	8.9	32.1	8.8	32.5	9.7	31.6
30	8.2	31.8	8.9	* 32.6	8.9	31.5
31			9.0	32.7		
MEANS	7.5	31.3	8.2	31.9	9.1	32.0
OBSVNS.	29	29	30	29	30	30
MAXIMUM	9.1	32.3	9.0	32.9	9.9	32.8
MINIMUM	6.8	30.7	7.5	31.4	8.6	31.2
STD.DEV.	.65	.40	.31	.46	.32	.35

PINE ISLAND 50 58 33 N 127 43 35 W

DATE	JULY TEMP	JULY SAL	AUGUST TEMP	AUGUST SAL	SEPTEMBER 1979 TEMP	SEPTEMBER 1979 SAL
1	9.2	32.8	10.1	32.0	10.5	31.8
2	9.5	31.4	10.2	31.6	10.1	32.3
3	10.1	31.5	10.1	31.9	10.1	32.9
4	9.2	31.5	10.0	31.5	11.5	32.3
5	9.0	31.8	10.2	31.9	10.5	32.3
6	10.2	31.8	10.1	31.6	11.2	32.5
7	9.9	31.1	10.1	31.6	10.8	31.6
8	9.9	31.5	9.8	32.4	10.7	31.8
9	9.8	31.5	9.8	32.0	11.5	31.8
10	9.5	31.5	9.8	31.9	10.9	32.7
11	9.1	31.5	10.0	32.0	10.1	32.1
12	10.2	31.6	9.2	32.8	10.6	31.8
13	10.5	31.9	9.2	32.4	10.5	32.7
14	10.2	31.6	9.5	32.1	10.1	32.7
15	10.0	31.8	9.8	32.4	10.8	32.4
16	10.0	31.6	10.1	31.9	10.6	31.9
17	9.8	32.1	9.5	31.4	12.0	31.9
18	9.6	31.8	9.5	31.6	11.6	32.1
19	10.2	31.1	9.5	31.9	11.9	32.5
20	10.2	31.2	9.9	31.6	11.0	32.4
21	10.1	31.5	10.5	32.5	10.9	32.1
22	9.8	31.4	10.1	31.8	10.6	32.9
23	10.1	31.4	10.9	32.1	10.5	32.8
24	10.2	31.6	10.1	32.1	10.4	32.8
25	9.9	31.5	10.0	32.0	10.2	32.9
26	10.1	31.6	10.9	32.7	10.2	32.5
27	9.8	31.8	10.5	32.5	10.0	32.7
28	10.1	31.2	10.9	32.4	10.0	32.5
29	9.8	31.8	10.9	32.7	10.0	32.4
30	10.2	31.5	10.5	32.1	11.0	32.7
31	9.8	31.5	10.5	31.6		
MEANS	9.9	31.6	10.1	32.0	10.7	32.4
OBSVNS.	31	31	31	31	30	30
MAXIMUM	10.5	32.8	10.9	32.8	12.0	32.9
MINIMUM	9.0	31.1	9.2	31.4	10.0	31.6
STD.DEV.	.37	.32	.47	.38	.57	.39

PINE ISLAND 50 58 33 N 127 43 35 W

	OCTOBER		NOVEMBER		DECEMBER	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	11.0	32.8	10.0	31.9	9.5	32.0
2	11.0	32.7	9.9	31.8	9.3	32.9
3	11.8	31.9	10.1	31.8	9.7	31.5
4	11.1	31.9	9.8	31.9	9.3	31.8
5	10.5	32.7	9.9	31.9	9.2	31.0
6	10.1	32.0	9.9	31.6	9.6	31.2
7	10.0	32.8	9.8	31.6	9.8	31.1
8	10.0	32.7	9.9	31.8	9.8	31.4
9	10.1	32.5	10.0	31.9	* 9.5	* 31.4
10	10.2	32.4	9.8	32.0	9.1	31.5
11	10.1	32.4	9.5	31.5	* 9.0	* 31.5
12	10.0	31.6	9.5	32.1	8.9	31.6
13	9.8	32.5	8.0	32.0	8.7	30.7
14	9.8	31.4	9.2	31.9	8.8	31.2
15	9.8	31.4	9.0	32.0	8.2	31.4
16	9.8	31.9	9.2	31.4	* 8.3	* 31.1
17	9.8	31.4	9.6	31.4	8.4	30.8
18	9.5	31.8	9.9	31.9	8.8	31.4
19	9.8	32.4	9.6	31.9	8.7	31.4
20	11.0	32.1	* 9.5	* 31.8	8.8	31.6
21	* 10.4	* 32.1	* 9.3	* 31.6	8.5	31.4
22	9.8	32.0	9.2	31.5	8.5	31.1
23	11.2	31.8	10.3	31.8	* 8.5	* 31.3
24	11.2	31.8	10.1	31.6	8.5	31.6
25	10.4	31.6	10.4	31.9	8.4	31.8
26	10.4	31.8	10.1	31.6	8.6	31.9
27	10.8	31.8	9.5	31.9	8.8	31.0
28	10.8	31.9	9.6	32.7	8.8	31.2
29	* 10.8	* 31.9	* 9.4	* 32.7	9.0	30.7
30	10.8	31.8	9.2	32.8	8.8	32.0
31	10.8	31.8			9.0	32.5
MEANS	10.4	32.1	9.7	31.9	8.9	31.5
OBSVNS.	29	29	27	27	27	27
YRLY.MEANS.....................................					8.8	31.7
MAXIMUM	11.8	32.8	10.4	32.8	9.8	32.9
MINIMUM	9.5	31.4	8.0	31.4	8.2	30.7
STD.DEV.	.58	.44	.49	.32	.45	.51

KAINS ISLAND 50 26 39 N 128 01 47 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	7.1	30.6	6.5	31.2	6.5	29.5
2	6.8	31.6	6.4	32.0	6.7	31.0
3	7.0	31.8	6.7	31.6	6.7	30.3
4	6.7	31.5	6.9	31.5	6.8	30.6
5	6.1	31.8	7.0	31.4	6.9	30.4
6	6.2	30.7	7.0	31.4	7.3	30.2
7	6.6	31.2	6.6	31.6	7.4	29.3
8	6.4	31.9	6.9	31.9	7.3	28.2
9	6.8	32.3	6.5	31.8	7.3	27.7
10	7.0	32.0	6.5	31.4	7.7	27.7
11	6.8	31.0	6.4	31.1	7.6	30.2
12	6.8	31.8	5.9	29.1	7.6	29.3
13	6.8	31.6	6.1	31.1	7.8	29.7
14	6.7	31.8	6.3	29.8	7.8	30.3
15	5.9	31.1	6.5	31.1	7.7	29.9
16	6.8	31.5	6.7	31.1	7.8	29.1
17	7.2	31.2	6.7	31.0	8.2	29.8
18	7.0	32.1	6.6	30.7	8.0	29.5
19	6.5	31.4	6.2	28.1	7.9	28.8
20	9.8	31.9	6.3	29.3	7.7	29.3
21	6.5	29.5	6.3	29.5	7.9	29.9
22	7.1	31.2	6.1	29.7	8.4	29.4
23	7.1	31.5	5.8	29.8	8.5	29.1
24	6.6	30.8	6.4	31.0	8.4	30.2
25	6.8	30.4	6.2	30.8	8.3	30.7
26	6.5	30.2	6.3	31.0	8.1	30.0
27	6.8	31.2	6.7	30.6	7.9	30.6
28	6.3	31.5	6.6	29.9	8.0	30.6
29	6.8	32.0			8.1	30.7
30	6.2	31.8			7.8	30.7
31	6.2	31.8			8.2	31.0
MEANS	6.8	31.4	6.5	30.7	7.7	29.8
OBSVNS.	31	31	28	28	31	31
MAXIMUM	9.8	32.3	7.0	32.0	8.5	31.0
MINIMUM	5.9	29.5	5.8	28.1	6.5	27.7
STD.DEV.	.65	.62	.31	.97	.54	.88

KAINS ISLAND 50 26 39 N 128 01 47 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	8.2	30.8	10.8	32.3	12.6	32.0
2	8.3	31.0	9.9	32.0	12.6	31.6
3	8.2	30.8	10.0	31.2	12.7	32.1
4	8.5	30.8	10.3	31.5	11.3	32.0
5	8.5	31.0	10.2	32.0	11.7	31.9
6	8.3	31.1	10.9	31.4	12.6	32.1
7	8.2	31.4	10.7	31.2	11.3	31.6
8	8.2	30.7	11.2	30.0	11.0	32.0
9	8.7	31.1	10.6	31.8	10.7	32.3
10	8.5	30.7	10.6	31.2	11.4	32.0
11	8.7	30.2	10.8	31.2	11.4	32.1
12	8.2	30.2	11.0	32.0	10.9	32.1
13	8.6	31.4	10.3	32.0	11.2	31.8
14	8.5	30.6	10.3	31.2	11.9	31.8
15	8.5	30.7	10.6	31.6	11.2	32.3
16	9.0	30.7	10.6	31.9	11.9	32.7
17	8.8	30.6	11.7	31.8	12.3	31.8
18	8.8	30.7	10.6	32.0	11.6	32.7
19	8.8	31.5	10.5	32.1	11.7	32.1
20	9.0	31.4	10.4	32.0	11.3	32.4
21	9.1	31.6	11.2	31.4	11.2	32.5
22	9.2	31.5	11.3	31.4	10.9	32.8
23	10.5	31.2	10.4	31.9	11.4	32.0
24	9.2	30.7	10.9	32.1	12.2	32.4
25	9.4	30.3	10.9	31.5	12.2	32.3
26	9.3	32.3	11.4	32.3	12.1	32.0
27	9.5	32.1	11.6	32.1	12.2	32.4
28	10.3	31.5	11.3	32.3	12.1	32.8
29	10.1	32.3	10.7	31.5	12.2	** 33.0
30	8.4	30.6	11.6	32.3	11.2	** 33.0
31			11.7	31.9		
MEANS	8.8	31.0	10.8	31.7	11.7	32.2
OBSVNS.	30	30	31	31	30	28
MAXIMUM	10.5	32.3	11.7	32.3	12.7	32.8
MINIMUM	8.2	30.2	9.9	30.0	10.7	31.6
STD.DEV.	.62	.56	.49	.49	.58	.33

KAINS ISLAND 50 26 39 N 128 01 47 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	12.2	32.5	13.3	32.5	16.1	32.5
2	11.3	32.3	13.9	** 33.0	16.1	32.3
3	12.1	32.5	12.3	** 33.0	15.7	32.0
4	12.5	31.9	12.7	32.9	15.8	32.3
5	13.2	** 33.0	12.4	32.5	15.4	31.2
6	14.0	32.8	13.2	32.7	15.2	31.0
7	14.1	32.8	13.7	32.8	15.1	31.1
8	14.0	32.0	13.3	32.5	14.9	32.0
9	13.9	32.8	12.8	32.8	15.7	31.4
10	13.3	32.0	12.8	32.3	15.2	30.7
11	13.7	31.9	13.1	32.5	15.6	30.2
12	14.3	32.1	13.9	32.7	15.8	30.3
13	14.6	32.3	13.1	32.8	15.5	30.8
14	14.5	32.0	12.8	32.8	14.8	31.5
15	15.1	31.9	13.1	32.5	14.7	31.2
16	15.1	32.5	13.7	32.5	15.3	31.8
17	16.0	32.7	14.2	32.8	15.5	31.9
18	15.8	32.3	14.4	32.4	15.8	31.5
19	12.8	32.5	15.2	32.4	16.1	31.2
20	13.0	32.7	15.2	32.5	14.8	31.8
21	12.7	32.7	15.6	32.5	15.4	31.8
22	13.1	32.1	14.7	32.3	15.2	32.0
23	13.4	32.0	15.0	32.1	14.5	31.9
24	13.1	32.8	15.5	32.4	13.2	31.4
25	12.9	32.8	16.4	32.7	13.1	31.5
26	13.3	32.9	16.2	32.5	13.0	31.4
27	12.8	** 33.0	15.3	32.7	13.5	30.6
28	13.4	** 33.2	16.1	32.5	13.7	30.8
29	12.2	32.4	16.3	32.8	13.7	31.0
30	12.1	** 33.2	15.4	32.8	13.7	31.5
31	12.8	32.9	15.6	32.7		
MEANS	13.5	32.4	14.2	32.6	14.9	31.4
OBSVNS.	31	27	31	29	30	30
MAXIMUM	16.0	32.9	16.4	32.9	16.1	32.5
MINIMUM	11.3	31.9	12.3	32.1	13.0	30.2
STD.DEV.	1.11	.35	1.29	.19	.95	.59

KAINS ISLAND 50 26 39 N 128 01 47 W

	OCTOBER		NOVEMBER		DECEMBER	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	13.7	30.8	10.8	30.0	9.7	30.3
2	13.9	31.5	10.9	30.4	9.7	29.9
3	13.4	31.4	10.9	30.2	10.2	30.4
4	14.0	30.7	10.8	30.0	9.7	30.2
5	14.1	31.0	11.1	30.6	10.6	30.7
6	13.4	31.4	10.8	30.6	10.2	29.4
7	14.2	31.4	10.7	30.7	10.2	29.7
8	13.1	31.2	10.8	30.7	9.9	29.3
9	12.6	31.1	11.1	30.8	9.6	28.6
10	13.0	31.6	10.6	31.0	9.6	29.0
11	13.6	31.5	10.4	31.1	9.7	29.9
12	13.5	31.4	10.3	30.7	10.1	29.9
13	13.1	31.2	11.0	31.0	10.2	29.7
14	12.9	31.4	10.3	30.8	9.3	30.2
15	12.2	31.1	10.6	30.8	9.2	29.3
16	12.9	31.5	10.6	31.1	9.4	29.5
17	12.8	31.5	10.9	31.2	9.7	29.9
18	12.3	31.4	10.2	30.6	9.2	28.5
19	11.9	30.7	11.1	31.2	9.7	29.0
20	11.5	30.8	10.8	31.0	9.3	27.4
21	11.6	30.6	10.9	30.8	9.1	26.4
22	11.6	31.0	10.5	30.3	9.2	26.9
23	11.9	31.8	9.9	28.9	8.6	28.5
24	12.1	31.1	10.2	27.7	8.6	28.0
25	11.8	31.1	8.6	27.2	9.1	28.2
26	11.6	31.2	9.2	29.3	9.7	29.0
27	11.5	31.0	8.7	29.5	9.6	28.6
28	11.2	30.4	9.3	29.9	9.2	27.2
29	10.9	28.2	9.7	30.3	8.4	26.9
30	10.9	29.0	10.1	30.0	8.7	26.9
31	10.8	30.0			8.8	28.2
MEANS	12.5	31.0	10.4	30.3	9.5	28.9
OBSVNS.	31	31	30	30	31	31
YRLY.MEANS....................................					10.6	31.1
MAXIMUM	14.2	31.8	11.1	31.2	10.6	30.7
MINIMUM	10.8	28.2	8.6	27.2	8.4	26.4
STD.DEV.	1.03	.75	.68	.96	.54	1.19

AMPHITRITE POINT 48 55 16 N 125 32 17 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	4.8	30.3	5.7	30.8	6.7	27.2
2	5.3	30.3	5.7	31.0	6.7	24.4
3	5.6	30.7	5.7	30.8	7.2	28.0
4	5.3	30.7	5.9	30.4	7.9	26.5
5	5.6	30.8	6.1	29.9	8.3	19.4
6	5.6	31.0	6.2	28.4	8.1	27.4
7	5.3	31.1	5.7	31.1	7.5	28.5
8	5.6	31.8	5.7	26.0	7.1	28.5
9	5.4	31.5	6.6	30.6	7.0	27.4
10	6.1	31.2	6.3	26.5	7.5	27.4
11	6.4	31.5	6.4	30.2	7.9	27.3
12	6.6	30.7	* 6.3	* 30.1	7.9	28.2
13	6.6	30.8	* 6.1	* 29.9	8.0	28.1
14	6.3	31.1	5.9	29.7	8.2	28.5
15	6.2	31.2	6.0	27.8	8.6	27.4
16	6.4	31.4	6.1	27.3	8.6	27.7
17	6.7	31.2	6.2	28.2	8.7	28.5
18	6.8	31.0	6.4	28.9	8.9	28.8
19	6.9	31.0	6.4	27.3	8.6	28.8
20	6.9	30.7	6.1	27.6	8.9	29.8
21	6.6	30.3	5.6	27.7	8.8	30.0
22	6.7	30.4	5.4	27.2	8.6	29.8
23	6.6	29.9	5.8	28.1	8.2	29.1
24	6.3	31.1	6.1	27.8	8.2	30.3
25	5.8	30.6	* 6.4	* 28.4	8.6	30.6
26	5.4	29.5	6.8	29.0	8.6	29.3
27	5.8	31.0	6.8	27.4	8.7	29.1
28	5.6	31.0	6.7	26.1	8.8	29.3
29	5.4	30.4			8.5	29.9
30	5.8	30.8			8.2	31.1
31	5.9	31.1			8.8	31.2
MEANS	6.0	30.8	6.1	28.6	8.1	28.3
OBSVNS.	31	31	25	25	31	31
MAXIMUM	6.9	31.8	6.8	31.1	8.9	31.2
MINIMUM	4.8	29.5	5.4	26.0	6.7	19.4
STD.DEV.	.58	.48	.39	1.61	.66	2.18

AMPHITRITE POINT 48 55 16 N 125 32 17 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	8.2	30.8	10.7	31.6	11.1	32.1
2	8.7	32.3	10.8	31.4	10.9	32.7
3	8.8	31.4	10.8	30.6	10.3	32.1
4	8.4	31.8	10.7	31.1	10.0	32.0
5	8.3	31.6	11.4	28.9	10.6	19.1
6	8.1	31.9	10.6	29.7	9.8	31.2
7	8.1	32.1	10.7	29.3	11.0	30.8
8	8.3	29.1	11.0	30.3	* 11.0	* 31.1
9	8.2	30.8	10.8	31.0	11.1	31.4
10	8.3	31.4	10.9	30.3	11.2	31.9
11	9.1	30.3	11.2	31.0	10.9	32.1
12	8.3	29.1	11.3	29.0	11.6	32.3
13	8.9	31.8	12.8	30.6	12.3	31.9
14	8.5	30.3	12.9	29.7	12.3	31.9
15	9.6	29.0	11.9	30.8	12.3	31.9
16	9.0	30.0	11.9	31.1	11.9	31.9
17	9.4	30.6	11.6	31.2	11.9	32.1
18	9.3	23.0	11.8	31.2	12.1	32.4
19	9.0	28.8	* 11.3	* 31.4	11.6	32.0
20	9.4	29.5	10.8	31.6	11.1	32.1
21	8.3	29.8	10.6	31.6	11.8	32.1
22	9.3	29.8	12.1	31.1	11.6	32.0
23	10.3	29.9	11.9	31.4	12.1	30.8
24	10.2	29.9	11.9	31.6	12.8	30.7
25	10.4	30.4	11.9	31.6	13.6	31.5
26	10.8	30.8	11.8	31.9	12.9	31.1
27	11.5	30.8	11.9	31.6	11.7	32.4
28	10.8	31.6	12.2	31.4	11.5	32.1
29	11.4	32.8	12.1	31.1	11.7	32.1
30	10.6	31.9	12.0	31.4	11.7	31.9
31			12.1	31.6		
MEANS	9.2	30.4	11.5	30.9	11.6	31.4
OBSVNS.	30	30	30	30	29	29
MAXIMUM	11.5	32.8	12.9	31.9	13.6	32.7
MINIMUM	8.1	23.0	10.6	28.9	9.8	19.1
STD.DEV.	1.04	1.77	.67	.83	.85	2.42

AMPHITRITE POINT 48 55 16 N 125 32 17 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	11.2	31.9	13.6	31.4	14.2	30.7
2	11.8	32.1	13.2	31.5	13.5	30.3
3	13.6	32.0	13.4	31.6	12.9	31.1
4	12.8	31.8	12.8	31.4	13.3	28.4
5	12.8	31.4	13.4	31.6	13.1	28.6
6	12.9	31.8	12.8	31.6	13.9	29.3
7	13.2	31.6	13.7	32.0	14.2	29.1
8	13.1	29.3	14.2	31.1	14.6	30.6
9	12.9	31.0	14.2	31.5	15.1	30.8
10	11.9	31.9	13.5	31.2	15.6	28.4
11	13.1	30.0	14.0	31.6	15.8	29.5
12	13.6	30.6	13.9	31.6	15.8	29.5
13	13.9	29.7	14.5	32.1	15.8	29.5
14	13.4	31.0	13.9	32.1	15.3	29.9
15	14.7	31.2	13.7	31.5	15.6	29.8
16	15.7	31.2	13.6	31.5	15.6	30.2
17	13.9	31.6	13.6	31.4	15.7	30.4
18	13.8	31.5	14.3	31.1	15.7	31.1
19	14.1	31.4	14.4	30.7	15.7	31.1
20	14.4	31.4	15.0	30.4	15.6	31.0
21	13.9	32.3	14.7	30.6	15.6	30.8
22	13.9	31.5	14.3	30.2	15.7	31.0
23	13.9	30.4	14.4	30.6	15.6	31.0
24	14.0	30.8	14.7	30.8	15.8	30.0
25	13.6	31.5	14.4	32.1	15.6	30.0
26	13.9	31.1	14.5	32.1	15.1	29.5
27	13.4	31.5	14.4	32.3	14.7	26.8
28	14.3	31.9	14.2	31.8	14.5	31.0
29	14.3	31.9	14.3	31.6	13.7	30.8
30	14.5	30.6	14.4	31.9	13.1	31.1
31	15.3	30.7	14.3	31.9		
MEANS	13.6	31.2	14.0	31.4	14.9	30.0
OBSVNS.	31	31	31	31	30	30
MAXIMUM	15.7	32.3	15.0	32.3	15.8	31.1
MINIMUM	11.2	29.3	12.8	30.2	12.9	26.8
STD.DEV.	.95	.71	.55	.54	.99	1.04

AMPHITRITE POINT 48 55 16 N 125 32 17 W

	OCTOBER		NOVEMBER		DECEMBER	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	13.2	31.2	10.7	26.8	9.3	29.1
2	13.1	30.8	11.1	28.4	9.2	29.4
3	13.3	30.3	12.0	28.6	9.2	29.1
4	13.3	30.3	11.4	29.0	10.3	30.8
5	13.9	29.7	11.7	29.5	10.6	30.2
6	14.0	30.3	11.4	28.6	10.3	30.3
7	13.3	30.6	11.8	29.7	10.1	30.0
8	14.4	30.6	11.5	29.1	11.1	30.2
9	14.0	30.6	11.6	29.8	* 10.9	* 30.2
10	13.1	30.8	11.2	29.7	10.6	30.3
11	12.7	31.2	10.8	29.4	10.1	30.8
12	12.8	31.1	10.7	29.7	9.9	31.5
13	12.6	31.4	10.4	29.8	10.0	28.8
14	12.4	31.0	10.1	30.0	10.1	28.2
15	12.5	30.8	10.8	30.7	8.9	26.9
16	12.7	30.7	10.9	29.9	9.1	27.8
17	11.4	31.5	10.7	29.7	* 9.5	* 28.4
18	11.9	30.7	10.6	30.6	10.0	29.0
19	11.0	29.9	10.3	30.7	9.8	29.8
20	11.0	31.4	10.6	30.2	9.7	29.5
21	11.1	30.7	* 10.5	* 30.3	9.6	29.3
22	* 11.1	* 30.3	* 10.4	* 30.5	9.0	28.1
23	11.1	29.8	10.3	30.6	* 9.1	* 27.9
24	11.3	29.5	10.1	30.7	9.2	27.6
25	* 11.7	* 29.7	9.4	28.6	9.2	27.8
26	12.2	31.0	8.8	28.9	9.6	28.4
27	12.1	30.6	8.5	28.5	9.1	27.6
28	11.9	30.2	8.9	29.8	9.0	27.8
29	11.4	29.2	* 9.3	* 30.3	9.3	27.8
30	11.3	29.3	9.7	30.8	9.3	28.1
31	11.0	27.8			9.2	27.8
MEANS	12.4	30.4	10.6	29.5	9.7	29.0
OBSVNS.	29	29	27	27	28	28
YRLY.MEANS..					10.7	30.2
MAXIMUM	14.4	31.5	12.0	30.8	11.1	31.5
MINIMUM	11.0	27.8	8.5	26.8	8.9	26.9
STD.DEV.	1.04	.80	.92	.93	.58	1.21

CAPE BEALE 48 47 12 N 125 12 53 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	6.0	31.55	* 5.8	* 31.62	7.6	29.89
2	6.4	31.49	5.9	31.42	7.7	29.59
3	6.0	31.49	6.1	31.77	7.6	29.70
4	6.0	31.48	* 6.2	* 31.52	*	*
5	* 5.3	* 31.60	6.3	31.27	*	*
6	4.6	31.72	6.5	31.43	*	*
7	6.0	31.76	6.1	31.47	7.4	27.57
8	5.9	31.86	* 6.3	* 30.50	7.6	29.35
9	6.2	31.83	6.5	29.52	7.3	29.12
10	6.4	31.64	6.6	29.68	7.7	29.67
11	6.6	32.90	6.6	30.06	8.6	29.54
12	6.7	31.78	6.5	30.16	8.2	30.22
13	6.6	31.88	* 6.6	* 29.79	8.3	30.24
14	6.5	32.09	6.7	29.41	* 8.4	* 30.24
15	6.5	31.98	5.7	27.73	* 8.5	* 30.23
16	6.6	32.02	5.9	27.28	8.6	30.23
17	7.0	31.90	6.5	26.65	* 9.1	* 29.91
18	* 6.9	* 31.53	6.7	28.73	9.7	29.58
19	6.7	31.16	* 6.4	* 28.86	*	*
20	7.7	29.96	* 6.0	* 28.99	*	*
21	* 7.0	* 30.55	5.7	29.13	*	*
22	6.2	31.15	6.6	29.73	*	*
23	6.5	30.75	6.5	29.71	*	*
24	6.4	31.14	* 6.7	* 29.36	*	*
25	* 6.5	31.45	6.9	29.01	*	*
26	6.2	31.25	*	*	8.2	30.73
27	6.1	31.36	*	*	7.9	31.04
28	6.0	31.63	*	*	* 8.3	* 30.96
29	6.0	31.58			* 8.7	* 30.87
30	5.9	31.71			9.1	30.78
31	5.7	31.82			9.6	31.24
MEANS	6.3	31.58	6.4	29.68	8.2	29.91
OBSVNS.	27	28	18	18	16	16
MAXIMUM	7.7	32.90	6.9	31.77	9.7	31.24
MINIMUM	4.6	29.96	5.7	26.65	7.3	27.57
STD.DEV.	.53	.507	.36	1.477	.75	.881

CAPE BEALE 48 47 12 N 125 12 53 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	8.9	31.16	* 10.4	* 32.1	11.6	31.5
2	* 9.1	* 31.02	10.5	32.1	11.9	31.5
3	* 9.4	* 30.87	* 11.0	* 32.1	12.1	32.1
4	9.6	30.73	11.5	32.1	11.9	31.5
5	* 9.3	* 30.94	9.8	31.0	11.0	32.1
6	* 8.9	* 31.16	* 10.1	* 30.8	* 11.1	*
7	8.6	31.37	10.5	30.5	11.2	*
8	7.8	30.56	10.9	31.0	11.6	*
9	8.4	31.42	11.2	32.1	* 11.7	*
10	8.3	31.37	* 11.9	* 30.8	* 11.9	*
11	* 8.2	* 31.31	12.6	29.4	12.1	*
12	8.0	31.24	11.6	29.4	* 12.4	*
13	8.6	31.35	* 12.2	* 29.1	12.8	*
14	8.6	* 31.41	* 12.9	* 28.7	11.5	31.72
15	9.2	31.48	13.6	28.3	11.8	32.01
16	9.7	30.92	13.9	28.3	12.6	30.94
17	9.7	31.39	*	*	12.8	31.91
18	* 10.0	* 31.47	*	*	* 12.0	* 31.94
19	10.4	31.56	*	*	11.2	31.97
20	10.5	31.54	11.8	30.5	11.6	31.60
21	9.1	31.44	11.0	30.5	*	*
22	9.1	31.40	10.6	31.0	*	*
23	9.5	31.56	11.3	31.0	*	*
24	9.5	31.61	11.7	21.9	13.6	31.94
25	10.0	32.1	11.9	31.0	11.9	31.73
26	10.5	31.5	11.6	32.1	10.8	32.05
27	10.6	31.5	11.7	31.0	12.6	30.90
28	10.8	32.1	* 12.7	* 31.8	10.8	32.09
29	12.6	31.0	13.7	32.6	10.3	32.30
30	10.4	32.1	13.6	32.6	12.0	31.32
31			13.8	32.1		
MEANS	9.5	31.41	11.8	30.5	11.8	31.73
OBSVNS.	24	23	21	21	22	18
MAXIMUM	12.6	32.1	13.9	32.6	13.6	32.30
MINIMUM	7.8	30.56	9.8	21.9	10.3	30.90
STD.DEV.	1.09	.384	1.23	2.34	.77	.399

CAPE BEALE 48 47 12 N 125 12 53 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	11.0	31.03	14.8	29.4	* 12.3	* 31.7
2	10.6	32.14	12.8	31.5	11.9	32.1
3	11.2	32.23	12.9	32.1	11.8	31.5
4	11.0	32.07	12.5	31.0	12.0	32.1
5	11.6	32.22	13.3	30.5	* 12.7	* 31.8
6	11.6	32.10	12.7	31.5	13.5	31.5
7	12.0	32.09	* 12.5	* 31.5	13.9	31.0
8	* 11.8	* 31.44	* 12.3	* 31.5	14.5	28.8
9	11.6	30.79	12.1	31.5	14.6	31.0
10	* 11.6	* 30.87	* 12.3	* 31.5	14.0	30.5
11	* 11.6	* 30.96	12.6	31.5	14.1	28.8
12	11.6	31.05	* 12.3	* 31.8	14.1	30.5
13	13.0	31.25	12.1	32.1	14.1	30.5
14	* 14.0	* 30.95	* 11.9	* 31.8	14.0	29.9
15	* 15.1	* 30.64	11.6	31.5	14.0	29.9
16	16.2	30.34	13.0	31.0	13.6	29.4
17	13.0	32.20	* 12.3	* 31.2	13.6	29.9
18	16.0	29.13	11.5	31.5	12.0	31.0
19	14.6	29.88	11.6	31.5	12.6	31.0
20	13.0	31.15	12.0	32.1	13.1	31.0
21	2.0	31.81	*	*	13.1	30.5
22	11.6	32.10	*	*	12.5	31.5
23	* 11.7	* 31.97	*	*	12.0	31.0
24	11.8	31.84	12.6	31.5	11.9	31.5
25	12.0	31.52	* 12.2	* 31.5	11.6	31.5
26	* 12.4	* 31.5	11.8	31.5	11.0	31.5
27	* 12.9	* 31.5	* 12.9	* 31.0	11.0	30.5
28	13.3	31.5	14.1	30.5	11.4	31.0
29	13.0	32.1	11.6	32.1	11.4	30.5
30	14.0	31.5	13.2	31.0	10.6	31.5
31	* 14.4	* 30.5	* 12.8	* 31.3		
MEANS	12.1	31.46	12.6	31.3	12.8	30.8
OBSVNS.	22	22	19	19	28	28
MAXIMUM	16.2	32.23	14.8	32.1	14.6	32.1
MINIMUM	2.0	29.13	11.5	29.4	10.6	28.8
STD.DEV.	2.72	.829	.86	.67	1.22	.86

CAPE BEALE 48 47 12 N 125 12 53 W

	OCTOBER		NOVEMBER		DECEMBER	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	10.6	31.0	11.6	31.0	10.4	29.9
2	10.2	31.0	11.8	31.0	10.1	29.9
3	9.1	31.0	11.8	30.5	10.5	30.5
4	10.1	31.0	11.8	30.5	10.2	29.9
5	10.0	31.5	11.9	31.0	* 10.4	* 30.2
6	10.0	31.5	11.6	31.0	10.6	30.5
7	10.0	31.5	11.4	31.0	10.4	29.4
8	10.0	31.5	10.7	31.0	9.6	30.5
9	10.0	31.5	10.6	31.0	9.5	28.8
10	10.0	31.5	11.3	31.0	9.3	29.4
11	9.6	31.5	10.1	31.5	*	*
12	9.6	31.5	* 10.4	* 31.5	*	*
13	10.6	31.5	10.7	31.5	*	*
14	10.0	31.5	10.8	32.6	*	*
15	10.2	32.1	10.9	32.6	9.6	30.5
16	10.0	31.5	* 11.1	* 32.1	8.6	28.3
17	10.2	31.5	11.3	31.5	9.6	28.3
18	10.0	31.5	10.7	31.5	9.5	28.8
19	10.0	31.5	10.7	31.5	9.4	28.8
20	10.0	31.5	10.4	31.5	9.6	28.3
21	*	*	9.1	31.0	9.6	28.3
22	*	*	* 9.3	* 29.9	9.5	30.5
23	*	*	9.6	28.8	9.5	30.5
24	*	*	9.4	29.9	9.6	28.8
25	*	*	9.5	31.0	9.6	28.3
26	12.6	29.4	9.1	30.5	9.6	27.2
27	12.6	29.9	8.6	31.0	9.6	27.8
28	12.6	30.5	9.6	31.5	9.5	27.2
29	* 12.3	* 30.5	9.6	30.5	9.5	28.8
30	* 11.9	* 30.5	9.6	29.9	9.2	28.3
31	11.6	30.5			9.5	28.8
MEANS	10.4	31.2	10.5	31.0	9.7	29.1
OBSVNS.	24	24	27	27	26	26
YRLY.MEANS...					10.2	30.82
MAXIMUM	12.6	32.1	11.9	32.6	10.6	30.5
MINIMUM	9.1	29.4	8.6	28.8	8.6	27.2
STD.DEV.	.96	.60	.98	.76	.44	1.04

BAMFIELD 48 50 05 N 125 08 07 W

DATE	JANUARY TEMP	JANUARY SAL	FEBRUARY TEMP	FEBRUARY SAL	MARCH TEMP	MARCH SAL 1979
1	*	*	6.0	31.59	7.0	
2	7.0	31.54	6.0	26.89	*	26.08
3	7.5	31.55	*	*	*	*
4	*	*	*	*	*	*
5	*	*	*	*	*	*
6	*	*	*	*	*	*
7	*	*	*	*	*	*
8	*	*	6.0	30.62	*	*
9	6.5	31.64	6.0	31.41	*	*
10	6.5	31.49	6.0	31.40	*	*
11	6.5	31.45	5.0	25.24	*	*
12	6.0	31.42	5.0	27.60	*	*
13	* 6.0	* 31.53	* 5.5	* 28.15	8.5	27.72
14	* 6.0	* 31.65	6.0	28.69	8.5	25.43
15	6.0	31.76	5.5	29.84	9.0	28.49
16	5.5	31.72	6.0	* 27.79	*	*
17	9.0	31.71	6.0	25.74	*	*
18	5.5	31.78	* 6.5	26.03	*	*
19	6.5	*	7.0	24.42	*	*
20	*	*	*	*	10.0	26.02
21	*	*	*	*	*	*
22	*	*	*	*	*	*
23	*	*	7.0	27.74	*	*
24	*	*	6.0	27.36	*	*
25	*	*	7.5	28.76	*	*
26	*	*	8.0	27.94	9.0	28.18
27	*	*	* 8.0	* 26.35	*	*
28	*	*	8.0	24.75	*	*
29	*	*			*	*
30	*	*			*	*
31	*	*			*	*
MEANS	6.6	31.61	6.3	28.00	8.7	26.99
OBSVNS.	11	10	17	17	6	6
MAXIMUM	9.0	31.78	8.0	31.59	10.0	28.49
MINIMUM	5.5	31.42	5.0	24.42	7.0	25.43
STD.DEV.	1.00	.133	.90	2.362	.98	1.296

BAMFIELD 48 50 05 N 125 08 07 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	*	*	13•0	27•93	*	*
2	*	*	*	*	*	*
3	*	*	*	*	*	*
4	*	*	*	*	*	*
5	*	*	*	*	12•5	30•16
6	*	*	*	*	* 13•5	* 28•65
7	*	*	*	*	14•5	27•14
8	*	*	*	*	15•8	23•44
9	*	29•77	*	*	*	*
10	*	*	*	*	*	*
11	*	*	13•5	25•94	*	*
12	*	*	* 14•1	* 26•77	*	*
13	*	*	* 14•8	* 27•61	16•0	27•01
14	*	*	15•5	28•45	16•2	25•64
15	*	*	* 15•0	* 27•18	*	*
16	*	*	* 14•5	* 25•91	*	*
17	8•5	26•52	14•0	24•64	*	*
18	9•0	24•86	*	*	*	*
19	*	*	*	*	*	*
20	*	*	*	*	14•0	29•85
21	*	*	*	*	* 14•4	*
22	*	*	*	*	14•8	
23	*	*	13•0	28•04	*	
24	9•5	26•12	* 13•0	* 26•96	*	
25	10•5	27•76	13•1	25•88	*	
26	11•0	29•73	12•6	27•52	*	
27	*	*	* 13•4	* 27•80	*	
28	*	*	14•3	28•08	*	
29	*		*	*	*	
30	11•5	29•02	*	*	*	*
31			*	*		
MEANS	10•0	27•68	13•6	27•06	14•8	27•21
OBSVNS•	6	7	8	8	7	6
MAXIMUM	11•5	29•77	15•5	28•45	16•2	30•16
MINIMUM	8•5	24•86	12•6	24•64	12•5	23•44
STD•DEV•	1•18	1•919	•94	1•384	1•32	2•545

BAMFIELD 48 50 05 N 125 08 07 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	*	*	*	*	*	*
2	*	*	*	*	*	*
3	*	*	*	*	*	*
4	*	*	*	*	*	*
5	13.5	*	*	*	*	*
6	* 13.8	*	*	*	*	*
7	14.2	*	*	*	*	*
8	*	*	*	*	*	*
9	*	*	*	*	*	*
10	*	*	*	*	17.0	*
11	*	*	*	*	16.8	*
12	16.5	*	*	*	17.5	*
13	16.7	*	*	*	*	*
14	*	*	*	*	*	*
15	*	*	*	*	*	*
16	*	*	15.3	*	*	*
17	*	*	* 15.2	*	*	*
18	18.2	*	15.0	*	*	*
19	18.0	*	15.0	*	*	*
20	*	*	16.5	*	*	*
21	*	*	15.8	*	*	*
22	*	*	* 14.8	*	*	*
23	*	*	13.8	*	*	*
24	*	*	* 15.3	*	*	*
25	*	*	16.8	*	*	*
26	*	*	*	*	*	*
27	*	*	*	*	*	*
28	*	*	*	*	*	*
29	*	*	*	*	*	*
30	*	*	*	*	*	*
31	*	*	*	*		
MEANS	16.2	0.0	15.5	0.0	17.1	0.0
OBSVNS.	6	0	7	0	3	0
MAXIMUM	18.2	0.0	16.8	0.0	17.5	0.0
MINIMUM	13.5	0.0	13.8	0.0	16.8	0.0
STD.DEV.	1.94	0.00	1.02	0.00	.36	0.00

BAMFIELD 48 50 05 N 125 08 07 W

DATE	OCTOBER TEMP	OCTOBER SAL	NOVEMBER TEMP	NOVEMBER SAL	DECEMBER 1979 TEMP	DECEMBER 1979 SAL
1	*	*	*	*	*	*
2	*	*	*	*	*	*
3	*	*	*	*	*	*
4	*	*	*	*	*	*
5	*	*	*	*	*	*
6	*	*	*	*	*	*
7	*	*	*	*	*	*
8	*	*	*	*	*	*
9	*	*	*	*	*	*
10	*	*	*	*	*	*
11	*	*	*	*	*	*
12	*	*	*	*	*	*
13	*	*	*	*	*	*
14	*	*	*	*	*	*
15	*	*	*	*	*	*
16	*	*	*	*	*	*
17	*	*	*	*	*	*
18	*	*	*	*	*	*
19	*	*	*	*	*	*
20	*	*	*	*	*	*
21	*	*	*	*	*	*
22	*	*	*	*	*	*
23	*	*	*	*	*	*
24	*	*	*	*	*	*
25	*	*	*	*	*	*
26	*	*	*	*	*	*
27	*	*	*	*	*	*
28	*	*	*	*	*	*
29	*	*	*	*	*	*
30	*	*	*	*	*	*
31	*	*			*	*
MEANS	0.0	0.0	0.0	0.0	0.0	0.0
OBSVNS.	0	0	0	0	0	0
YRLY.MEANS..						
MAXIMUM	0.0	0.0	0.0	0.0	0.0	0.0
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0
STD.DEV.	0.00	0.00	0.00	0.00	0.00	0.00

SHERINGHAM POINT 48 22 40 N 123 55 10 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	6•2	32•1	6•7	31•6	7•2	31•2
2	6•4	31•2	6•6	31•8	7•3	31•4
3	5•5	32•0	6•7	31•6	7•3	31•5
4	5•6	32•1	6•9	31•9	7•4	31•4
5	5•7	31•4	6•9	31•9	6•8	31•4
6	5•8	31•9	6•8	31•2	7•1	30•4
7	6•2	31•6	7•3	32•4	7•2	31•0
8	6•4	31•5	6•8	31•5	7•0	30•7
9	5•4	31•5	* 6•8	* 31•5	7•3	30•7
10	5•9	31•5	6•8	31•5	7•8	30•8
11	6•7	31•9	6•9	31•6	7•8	30•7
12	6•7	31•8	6•9	31•6	7•9	30•6
13	7•1	31•9	* 6•8	* 30•9	7•8	30•8
14	6•6	31•8	6•6	30•2	7•8	30•7
15	6•5	31•8	6•7	31•0	8•2	31•0
16	7•2	32•3	6•6	30•7	8•1	30•7
17	7•3	32•1	6•7	30•7	7•9	31•1
18	7•2	31•9	6•7	30•8	7•9	31•2
19	* 7•2	* 31•8	6•8	30•8	8•1	30•8
20	7•3	31•6	6•3	30•4	8•1	30•8
21	7•2	31•9	6•5	30•6	8•0	30•8
22	7•2	32•0	6•3	30•6	7•9	30•8
23	7•2	31•6	6•4	30•6	8•0	30•7
24	7•3	31•6	6•6	30•7	8•1	30•7
25	6•9	31•8	6•7	30•7	8•2	30•7
26	6•9	31•8	6•9	31•4	8•1	30•7
27	6•9	31•8	7•2	31•4	8•1	30•8
28	7•0	31•6	7•0	31•2	8•2	30•8
29	6•9	31•6			8•2	30•7
30	7•0	31•6			8•3	31•8
31	6•4	32•0			8•3	31•8
MEANS	6•6	31•8	6•7	31•2	7•8	30•9
OBSVNS•	30	30	26	26	31	31
MAXIMUM	7•3	32•3	7•3	32•4	8•3	31•8
MINIMUM	5•4	31•2	6•3	30•2	6•8	30•4
STD•DEV•	•59	•24	•24	•56	•43	•35

SHERINGHAM POINT 48 22 40 N 123 55 10 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	8.2	31.8	9.3	31.9	10.9	31.9
2	8.3	31.6	9.3	31.8	10.7	31.6
3	8.2	31.9	9.3	31.9	10.6	31.8
4	8.0	31.4	9.2	31.8	10.6	31.5
5	8.4	31.6	9.3	31.8	10.7	31.9
6	8.4	31.6	9.3	31.6	10.6	31.9
7	8.9	31.5	9.6	32.1	10.6	32.0
8	8.9	31.5	9.4	31.8	10.9	32.0
9	8.8	31.4	9.3	31.9	10.7	31.9
10	8.7	31.6	9.8	32.0	10.7	32.1
11	8.9	31.1	10.8	31.4	10.8	32.0
12	9.3	31.6	10.7	32.0	10.7	32.3
13	9.0	31.4	10.6	32.3	10.7	32.0
14	8.9	31.4	10.6	32.5	10.0	32.1
15	8.9	31.5	10.7	32.4	10.4	32.0
16	9.0	31.6	10.8	32.3	10.4	31.5
17	8.3	31.4	10.7	32.1	10.4	31.2
18	8.6	31.5	10.9	32.1	10.4	31.5
19	8.4	31.9	9.9	32.7	10.6	32.3
20	* 8.4	* 32.0	10.0	32.5	10.4	31.4
21	8.3	32.1	10.1	32.5	10.5	31.8
22	8.8	32.0	10.1	32.7	10.6	32.1
23	9.4	31.9	10.7	31.5	10.8	32.3
24	9.0	31.8	10.6	32.0	10.9	31.9
25	9.3	31.9	11.5	31.4	10.9	31.8
26	9.2	31.9	11.1	32.0	10.8	31.8
27	9.2	31.8	11.0	31.8	10.8	31.8
28	9.3	31.8	11.1	32.1	10.9	31.9
29	9.2	31.8	10.4	31.8	10.8	31.8
30	9.3	31.8	10.7	31.8	10.6	31.9
31			10.7	31.6		
MEANS	8.8	31.7	10.2	32.0	10.6	31.9
OBSVNS.	29	29	31	31	30	30
MAXIMUM	9.4	32.1	11.5	32.7	10.9	32.3
MINIMUM	8.0	31.1	9.2	31.4	10.0	31.2
STD.DEV.	.41	.23	.69	.35	.20	.26

SHERINGHAM POINT 48 22 40 N 123 55 10 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	10.3	32.0	11.6	31.6	11.2	31.6
2	10.6	31.8	11.7	31.6	11.1	31.5
3	10.9	31.5	11.6	31.6	11.0	31.2
4	11.1	31.8	11.4	31.4	11.1	31.5
5	11.2	31.9	11.4	31.4	10.9	31.2
6	10.8	31.2	11.3	31.5	11.4	31.6
7	10.9	31.6	11.2	31.4	11.6	31.4
8	10.9	31.4	11.3	31.5	11.6	31.4
9	10.8	31.6	11.3	31.4	11.9	31.2
10	10.8	31.2	11.3	31.4	11.9	31.6
11	10.7	31.8	11.1	31.8	11.4	31.4
12	10.9	32.0	10.9	32.0	12.0	30.8
13	10.8	32.0	10.7	32.4	12.3	31.0
14	10.8	32.0	10.8	32.4	12.0	30.8
15	11.3	32.0	10.8	32.1	11.3	30.7
16	11.5	31.6	10.7	32.1	11.3	30.8
17	10.8	31.8	10.7	32.0	11.4	30.8
18	11.2	31.5	10.7	32.1	11.8	30.8
19	10.6	32.0	10.8	32.1	11.9	30.8
20	11.2	31.8	10.7	32.1	11.7	30.8
21	11.1	31.6	10.9	31.6	11.8	31.0
22	11.1	32.1	* 11.0	* 31.6	11.9	31.1
23	12.2	31.1	11.1	31.5	12.2	31.0
24	11.2	31.4	11.2	31.5	11.9	30.8
25	11.2	31.6	11.1	31.8	12.1	31.0
26	11.1	31.5	11.2	32.3	12.5	31.1
27	11.3	31.8	11.1	32.0	12.1	30.8
28	11.4	32.1	11.2	31.8	12.0	31.0
29	11.6	31.8	11.1	31.6	11.9	30.8
30	11.7	31.6	11.0	31.4	11.8	31.0
31	11.7	30.7	11.3	31.5		
MEANS	11.1	31.7	11.1	31.8	11.7	31.1
OBSVNS.	31	31	30	30	30	30
MAXIMUM	12.2	32.1	11.7	32.4	12.5	31.6
MINIMUM	10.3	30.7	10.7	31.4	10.9	30.7
STD.DEV.	.39	.32	.29	.33	.41	.29

SHERINGHAM POINT 48 22 40 N 123 55 10 W

	OCTOBER		NOVEMBER		DECEMBER	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	11.8	31.0	10.8	31.2	9.2	31.2
2	11.2	31.1	10.6	31.4	9.0	31.6
3	11.3	31.0	10.2	31.6	8.8	31.5
4	11.2	31.0	9.8	31.9	8.7	31.6
5	11.2	30.8	9.9	31.9	8.8	31.5
6	11.1	31.8	10.1	31.9	8.8	31.5
7	10.3	32.3	10.0	31.9	9.0	31.4
8	10.2	32.1	10.1	31.9	8.8	31.5
9	10.3	32.4	9.9	31.6	8.9	31.5
10	10.1	32.4	10.1	31.8	8.9	31.4
11	10.2	32.4	10.1	31.8	8.9	31.4
12	10.0	31.8	10.0	31.8	8.9	31.5
13	10.1	31.5	9.4	31.4	8.8	31.4
14	10.1	31.6	9.7	31.8	8.9	31.5
15	10.0	31.8	9.6	31.5	8.6	30.3
16	10.2	31.4	9.6	31.6	8.6	30.4
17	10.1	31.8	9.4	31.2	8.7	30.7
18	10.0	31.2	9.3	30.8	8.7	30.6
19	10.1	31.2	9.3	31.0	8.6	30.4
20	10.0	31.1	9.4	30.8	8.6	30.6
21	10.0	31.2	9.3	30.8	8.6	30.3
22	9.9	31.1	9.3	31.0	8.6	30.6
23	10.1	31.1	9.2	30.8	8.6	30.4
24	10.1	31.1	9.2	30.8	8.6	30.3
25	10.0	31.2	9.3	30.8	8.6	30.4
26	10.7	31.4	9.2	31.0	8.6	30.4
27	10.7	31.2	9.3	30.7	8.6	31.5
28	10.7	31.4	9.2	30.7	8.6	30.6
29	10.7	31.1	9.3	31.4	8.6	30.3
30	10.4	31.2	9.3	30.8	8.6	30.0
31	10.4	31.1			8.7	29.9
MEANS	10.4	31.4	9.7	31.3	8.7	30.9
OBSVNS.	31	31	30	30	31	31
YRLY.MEANS..........					9.5	31.5
MAXIMUM	11.8	32.4	10.8	31.9	9.2	31.6
MINIMUM	9.9	30.8	9.2	30.7	8.6	29.9
STD.DEV.	.50	.47	.44	.45	.16	.57

RACE ROCKS 48 17 57 N 123 31 48 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	6.7	31.4	6.5	31.5	7.1	31.2
2	6.4	31.5	6.5	31.4	7.1	31.5
3	6.3	31.1	6.6	31.6	7.0	31.5
4	6.2	31.2	6.7	31.5	7.1	31.6
5	6.3	31.2	6.6	31.5	7.2	31.4
6	6.3	31.4	6.7	31.6	7.2	31.4
7	6.3	31.1	6.8	31.5	7.1	31.2
8	6.4	31.2	6.9	31.5	7.2	31.4
9	6.4	31.1	7.0	31.6	7.2	31.5
10	6.6	31.2	6.9	31.6	7.2	31.2
11	6.7	31.5	6.9	31.6	7.2	31.0
12	6.9	31.8	6.9	31.5	7.4	31.0
13	6.8	31.6	6.9	31.6	7.4	31.1
14	6.9	31.6	6.9	31.8	7.6	31.2
15	6.8	31.9	6.8	31.4	7.7	31.1
16	6.8	31.8	6.9	31.5	7.8	31.1
17	6.7	31.8	7.0	31.2	7.7	31.2
18	6.8	31.6	6.9	31.0	7.8	31.0
19	6.7	31.6	7.1	30.7	7.8	31.0
20	6.7	31.8	7.1	30.3	7.8	31.1
21	6.8	31.5	7.1	30.2	7.7	31.2
22	6.7	31.5	7.2	30.4	7.8	31.2
23	6.7	31.6	7.2	30.4	8.0	31.2
24	6.5	31.4	7.1	31.0	8.2	31.6
25	6.4	31.5	7.1	30.8	7.9	31.4
26	6.5	31.2	7.2	31.1	7.8	31.2
27	6.5	31.1	6.9	31.4	8.1	32.0
28	6.6	31.2	6.9	31.5	7.9	32.1
29	6.4	31.2			7.9	32.4
30	6.6	31.5			7.8	32.4
31	6.6	31.4			7.9	32.3
MEANS	6.6	31.4	6.9	31.2	7.6	31.4
OBSVNS.	31	31	28	28	31	31
MAXIMUM	6.9	31.9	7.2	31.8	8.2	32.4
MINIMUM	6.2	31.1	6.5	30.2	7.0	31.0
STD.DEV.	.20	.24	.20	.46	.36	.41

RACE ROCKS 48 17 57 N 123 31 48 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	8.0	32.0	9.0	30.7	9.8	31.6
2	8.1	31.9	8.9	30.8	9.8	31.5
3	7.9	32.0	9.1	31.1	9.9	31.6
4	8.1	31.8	9.0	31.1	9.9	31.4
5	8.1	31.6	8.9	31.5	9.9	31.4
6	8.0	31.2	9.3	31.5	10.0	31.1
7	8.1	31.2	9.8	31.4	10.0	31.1
8	8.1	31.2	9.6	31.2	9.8	31.2
9	8.2	31.5	9.5	31.6	9.7	31.4
10	8.2	31.4	9.4	31.6	9.6	31.5
11	8.4	31.4	9.3	31.8	9.6	31.6
12	8.3	31.5	9.5	31.5	9.7	31.8
13	8.4	31.5	9.4	31.6	9.8	31.8
14	8.3	31.6	9.6	31.6	9.8	31.6
15	8.3	31.6	9.6	31.8	9.9	31.6
16	8.4	31.4	9.6	31.5	9.9	31.9
17	8.3	31.5	9.6	31.6	9.8	31.6
18	8.4	31.4	9.7	31.9	9.8	31.8
19	8.4	31.2	9.7	31.6	9.8	31.5
20	8.4	31.5	9.6	31.8	9.8	31.6
21	8.4	31.2	9.7	31.6	9.8	31.8
22	8.5	31.5	9.8	31.5	10.0	31.9
23	8.7	31.6	9.8	31.6	10.2	31.6
24	8.7	32.0	9.9	31.8	10.4	31.9
25	8.8	31.9	9.9	31.8	10.5	31.6
26	8.7	32.0	9.9	31.9	10.4	31.8
27	8.8	31.8	9.8	32.0	10.6	31.6
28	8.8	31.9	9.6	32.1	10.7	31.5
29	8.8	31.8	9.7	31.6	10.6	31.8
30	8.9	31.8	9.8	31.6	10.7	31.6
31			9.8	31.8		
MEANS	8.4	31.6	9.5	31.6	10.0	31.6
OBSVNS.	30	30	31	31	30	30
MAXIMUM	8.9	32.0	9.9	32.1	10.7	31.9
MINIMUM	7.9	31.2	8.9	30.7	9.6	31.1
STD.DEV.	.28	.27	.30	.32	.34	.21

RACE ROCKS 48 17 57 N 123 31 48 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	10.7	31.6	11.7	31.2	10.1	31.5
2	10.6	31.4	11.5	31.1	10.0	31.6
3	10.7	31.4	11.3	31.4	10.6	31.9
4	10.6	31.2	11.3	31.5	10.4	31.9
5	10.6	31.4	11.1	31.6	10.3	31.8
6	10.6	31.5	10.9	31.5	10.2	32.0
7	9.9	31.4	10.9	31.8	10.0	32.1
8	10.9	31.6	10.8	31.4	10.2	32.0
9	9.9	31.9	10.8	31.5	10.2	32.1
10	9.8	32.3	10.8	31.5	10.3	32.0
11	9.8	32.4	10.9	31.6	10.4	32.1
12	10.0	32.1	10.9	31.8	10.5	32.1
13	10.2	32.0	10.9	31.9	10.6	32.0
14	10.2	31.8	11.0	31.5	10.6	31.8
15	10.4	31.8	10.9	31.5	10.7	31.5
16	10.6	31.6	10.9	31.8	10.8	31.5
17	11.1	31.4	10.8	31.6	10.8	31.8
18	11.0	31.5	10.7	31.9	10.9	31.4
19	11.2	31.2	10.8	31.8	10.9	31.4
20	11.2	31.4	10.7	31.9	11.0	31.1
21	11.3	31.1	10.7	32.0	10.9	31.2
22	11.3	31.2	10.6	31.8	10.9	31.0
23	11.4	31.0	10.6	31.6	10.8	31.0
24	11.5	31.1	10.4	31.9	10.7	31.1
25	11.6	31.0	10.3	31.9	10.6	31.2
26	11.7	31.0	10.4	31.6	10.6	31.1
27	11.8	31.1	10.2	31.8	10.4	31.0
28	11.9	31.4	10.3	31.5	10.4	30.8
29	11.7	31.1	10.3	31.6	10.3	30.7
30	11.8	31.2	10.4	31.5	10.2	30.8
31	11.9	31.0	10.2	31.6		
MEANS	10.9	31.5	10.8	31.6	10.5	31.5
OBSVNS.	31	31	31	31	30	30
MAXIMUM	11.9	32.4	11.7	32.0	11.0	32.1
MINIMUM	9.8	31.0	10.2	31.1	10.0	30.7
STD.DEV.	.67	.38	.37	.22	.29	.46

RACE ROCKS 48 17 57 N 123 31 48 W

	OCTOBER		NOVEMBER		DECEMBER	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	9.9	31.5	9.6	31.8	8.6	31.5
2	10.6	31.4	9.6	31.6	8.7	31.6
3	10.6	31.6	9.4	31.5	8.7	31.8
4	10.7	31.9	9.6	31.5	8.7	31.6
5	10.6	31.9	9.5	31.6	8.6	31.9
6	10.6	31.8	9.4	31.6	8.6	31.9
7	10.5	31.8	9.4	31.8	8.7	31.8
8	10.5	32.0	9.4	31.9	8.7	31.6
9	10.4	32.0	9.2	31.5	8.8	31.9
10	10.3	31.6	9.1	31.5	8.7	31.8
11	10.3	31.8	9.1	31.4	8.6	32.0
12	10.3	31.5	9.0	31.6	8.6	31.6
13	10.2	31.8	9.0	31.5	8.4	31.5
14	10.2	31.4	8.9	31.2	8.5	31.5
15	10.1	31.5	8.9	31.1	8.6	31.4
16	10.1	31.4	8.9	31.4	8.6	31.4
17	10.8	31.1	9.0	31.8	8.6	31.2
18	10.5	31.1	9.0	31.2	8.6	31.0
19	10.1	31.4	9.1	31.4	8.7	31.2
20	9.7	31.5	8.9	31.5	8.6	31.5
21	9.3	31.0	9.3	31.4	8.7	31.5
22	9.5	31.0	8.9	31.2	8.7	31.6
23	8.7	31.1	8.9	31.1	8.6	31.6
24	7.9	30.8	8.9	31.4	8.7	31.8
25	8.3	31.1	8.8	31.2	8.6	31.5
26	8.5	31.2	8.8	31.4	8.6	31.4
27	8.9	31.0	8.8	31.1	8.6	31.4
28	9.2	31.2	8.7	31.5	8.6	31.2
29	9.4	31.5	8.7	31.2	8.4	31.0
30	9.6	31.4	8.6	31.5	8.5	30.8
31	9.8	31.8			8.4	31.0
MEANS	9.9	31.5	9.1	31.4	8.6	31.5
OBSVNS.	31	31	30	30	31	31
YRLY.MEANS........					9.1	31.5
MAXIMUM	10.8	32.0	9.6	31.9	8.8	32.0
MINIMUM	7.9	30.8	8.6	31.1	8.4	30.8
STD.DEV.	.77	.33	.29	.22	.10	.30

CAPE MUDGE 49 59 56 N 125 11 38 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	* 5.7	* 28.9	7.4	29.4	7.1	28.4
2	5.6	29.0	7.5	29.5	* 7.2	* 28.8
3	6.7	29.0	6.9	29.3	7.4	29.3
4	6.3	29.1	* 7.2	* 29.4	* 7.5	* 29.3
5	7.1	29.1	7.5	29.5	7.6	29.4
6	7.2	29.0	* 7.8	* 29.4	7.8	29.3
7	6.9	29.0	8.1	29.3	7.9	28.9
8	7.1	29.0	* 8.2	* 29.3	7.8	29.4
9	* 7.4	* 29.4	8.3	29.4	8.1	29.5
10	7.8	29.8	* 8.3	* 29.4	8.6	29.5
11	7.9	29.4	8.2	29.4	* 8.5	* 29.5
12	7.9	29.3	7.3	29.3	8.4	29.4
13	7.9	29.3	* 6.7	* 29.1	8.7	29.4
14	7.6	29.4	6.0	28.8	8.1	29.4
15	4.9	29.1	*	*	7.3	29.4
16	6.3	29.0	*	*	7.4	29.5
17	* 6.7	* 29.1	*	*	7.2	29.5
18	7.2	29.3	7.1	29.0	7.7	29.4
19	7.0	29.3	7.2	28.8	7.4	29.4
20	* 6.6	* 29.3	*	*	7.6	29.4
21	6.2	29.3	*	*	7.9	29.3
22	7.4	29.3	*	*	8.1	29.4
23	* 7.5	* 29.3	7.4	28.9	8.6	29.5
24	7.6	29.4	* 7.5	* 28.7	8.8	29.4
25	* 7.7	* 29.4	* 7.6	* 28.6	8.3	29.4
26	* 7.8	* 29.4	7.7	28.4	7.8	29.3
27	7.9	29.4	7.9	28.9	7.3	29.4
28	7.6	29.4	7.6	28.6	7.3	29.3
29	6.9	29.3			7.2	29.4
30	7.4	29.4			6.9	29.3
31	7.1	29.4			6.7	29.3
MEANS	7.1	29.2	7.5	29.1	7.7	29.3
OBSVNS.	24	24	15	15	28	28
MAXIMUM	7.9	29.8	8.3	29.5	8.8	29.5
MINIMUM	4.9	29.0	6.0	28.4	6.7	28.4
STD.DEV.	.76	.20	.57	.35	.56	.22

CAPE MUDGE 49 59 56 N 125 11 38 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	7.5	29.4	8.5	29.7	9.9	29.8
2	*	*	9.2	30.0	11.8	28.9
3	*	*	9.1	29.7	15.0	28.1
4	*	*	9.3	29.7	* 12.7	* 28.7
5	8.2	29.5	9.9	29.7	10.3	29.3
6	9.2	29.5	* 10.0	* 29.7	12.4	29.3
7	* 9.0	* 29.5	10.1	29.8	12.5	29.7
8	* 8.9	* 29.5	11.7	29.9	11.6	29.1
9	8.7	29.5	11.2	29.5	11.7	29.7
10	7.1	29.9	11.6	30.0	9.2	29.5
11	7.4	29.8	8.8	30.2	8.9	29.7
12	* 7.5	* 29.8	9.2	29.9	8.9	30.0
13	* 7.7	* 29.8	9.2	29.9	8.7	29.5
14	7.8	29.8	9.0	30.2	9.1	29.5
15	7.8	29.7	8.9	30.3	10.8	28.8
16	8.8	29.7	9.1	30.2	12.1	28.8
17	8.2	29.5	9.6	29.8	13.8	28.1
18	8.2	29.7	10.2	29.4	16.3	26.7
19	8.5	29.4	10.6	29.8	16.2	25.8
20	9.1	29.5	10.1	29.7	* 15.5	* 26.3
21	9.8	29.7	10.6	29.9	14.7	26.9
22	9.2	29.7	* 11.1	* 30.1	* 14.6	* 27.1
23	9.4	29.5	11.6	30.3	14.4	27.3
24	8.2	29.5	11.4	30.0	12.6	27.8
25	8.2	29.7	9.3	29.5	12.0	27.7
26	8.2	29.5	9.8	29.4	12.4	27.7
27	8.4	29.5	10.2	29.8	10.9	28.4
28	8.4	29.5	9.0	29.9	10.0	29.3
29	8.6	29.7	9.6	29.8	10.3	29.0
30	8.7	29.8	9.1	30.0	9.4	29.9
31			9.6	30.0		
MEANS	8.4	29.6	9.8	29.9	11.7	28.7
OBSVNS.	23	23	29	29	27	27
MAXIMUM	9.8	29.9	11.7	30.3	16.3	30.0
MINIMUM	7.1	29.4	8.5	29.4	8.7	25.8
STD.DEV.	.66	.14	.93	.24	2.17	1.11

CAPE MUDGE 49 59 56 N 125 11 38 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	9.6	26.9	*	*	*	*
2	12.9	26.8	*	*	*	*
3	16.9	26.5	*	*	*	*
4	11.9	26.7	*	*	*	*
5	* 13.5	* 27.0	*	*	*	*
6	15.1	27.4	*	*	*	*
7	* 15.2	* 26.9	*	*	*	*
8	* 15.3	* 26.4	*	*	*	*
9	15.4	25.9	*	*	*	*
10	* 14.5	* 26.8	*	*	*	*
11	13.5	27.7	*	*	*	*
12	14.2	26.3	*	*	*	*
13	14.8	26.8	*	*	*	*
14	13.6	26.5	*	*	*	*
15	12.9	27.1	*	*	*	*
16	14.0	26.3	*	*	*	*
17	14.3	26.1	*	*	*	*
18	15.8	27.6	*	*	*	*
19	* 14.9	* 27.7	*	*	*	*
20	* 14.0	* 27.9	*	*	*	*
21	13.1	28.0	*	*	*	*
22	12.5	28.4	*	*	*	*
23	12.4	28.1	*	*	*	*
24	12.2	28.5	*	*	*	*
25	11.9	27.1	*	*	*	*
26	12.3	26.5	*	*	*	*
27	*	*	*	*	*	*
28	*	*	*	*	*	*
29	*	*	*	*	*	*
30	*	*	*	*	*	*
31	*	*	*	*		
MEANS	13.5	27.1	0.0	0.0	0.0	0.0
OBSVNS.	20	20	0	0	0	0
MAXIMUM	16.9	28.5	0.0	0.0	0.0	0.0
MINIMUM	9.6	25.9	0.0	0.0	0.0	0.0
STD.DEV.	1.66	.77	0.00	0.00	0.00	0.00

CAPE MUDGE 49 59 56 N 125 11 38 W

DATE	OCTOBER TEMP	OCTOBER SAL	NOVEMBER TEMP	NOVEMBER SAL	DECEMBER 1979 TEMP	DECEMBER 1979 SAL
1	*	*	10.1	28.0	8.0	28.5
2	12.8	29.1	9.7	28.1	8.4	28.4
3	12.8	28.1	7.9	28.5	7.5	28.4
4	12.2	28.1	8.4	29.1	6.7	28.2
5	13.6	28.8	7.9	28.4	7.6	27.8
6	11.4	29.0	7.2	28.6	8.4	28.6
7	11.1	28.8	7.6	28.2	8.0	29.1
8	11.1	29.5	7.7	28.5	8.1	29.1
9	9.4	29.3	9.1	28.5	7.9	28.5
10	9.9	28.6	9.1	29.0	6.6	28.2
11	10.1	28.0	9.2	28.5	7.7	28.6
12	11.4	27.6	9.9	28.6	7.9	28.8
13	10.8	28.8	8.5	29.1	* 7.6	* 28.9
14	12.6	28.0	9.7	28.4	7.3	29.0
15	11.6	27.8	* 9.2	* 28.3	6.8	29.3
16	11.6	27.7	* 8.6	* 28.2	7.5	29.0
17	9.9	29.4	8.1	28.2	* 7.8	* 29.1
18	10.6	28.5	8.8	28.9	8.2	29.3
19	9.7	29.0	8.7	28.2	* 8.1	* 29.2
20	11.2	29.4	*	*	* 7.9	* 29.1
21	*	*	*	*	7.8	29.0
22	*	*	*	*	6.9	28.9
23	*	*	7.9	28.4	*	*
24	*	*	7.9	28.9	*	*
25	9.9	28.8	* 7.8	* 28.5	*	*
26	10.0	28.6	7.7	28.0	*	*
27	* 10.3	* 28.6	7.8	28.0	8.3	28.8
28	10.7	28.5	7.5	28.2	* 8.2	* 28.6
29	10.8	28.8	7.9	28.6	8.1	28.4
30	10.1	28.1	7.6	28.5	8.2	28.5
31	10.2	28.0			* 8.1	* 28.6
MEANS	11.0	28.6	8.4	28.5	7.7	28.7
OBSVNS.	25	25	24	24	21	21
YRLY.MEANS........					9.3	28.9
MAXIMUM	13.6	29.5	10.1	29.1	8.4	29.3
MINIMUM	9.4	27.6	7.2	28.0	6.6	27.8
STD.DEV.	1.11	.56	.85	.34	.56	.39

CHROME ISLAND 49 28 20 N 124 40 57 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	6.9	29.4	6.6	29.4	6.9	29.5
2	7.2	29.5	6.8	29.4	7.3	29.5
3	6.9	29.5	7.0	29.4	7.5	29.9
4	6.9	29.3	7.1	29.5	7.6	29.8
5	6.8	29.3	7.2	29.5	7.7	29.8
6	6.9	29.3	7.3	29.3	7.9	29.4
7	6.8	29.3	7.3	29.4	7.9	29.7
8	7.0	29.4	7.2	29.4	7.6	28.8
9	6.8	29.3	7.8	29.4	6.8	26.4
10	6.9	29.3	7.5	29.5	7.4	28.8
11	6.9	29.1	7.4	29.4	8.1	29.7
12	6.9	29.4	7.3	29.5	8.2	29.5
13	6.9	29.1	7.4	29.5	8.6	29.7
14	6.8	29.4	7.1	29.1	8.4	29.0
15	6.8	29.4	7.3	29.3	8.1	29.7
16	6.8	29.3	7.6	29.3	7.8	29.7
17	6.8	29.1	7.3	29.5	7.5	29.5
18	7.2	29.3	7.4	29.5	7.8	29.5
19	7.2	29.3	7.4	29.7	7.3	29.1
20	7.2	29.5	6.9	29.1	7.8	29.0
21	7.1	29.5	6.1	27.1	7.9	28.1
22	7.1	29.1	6.1	28.4	8.4	28.9
23	7.0	29.5	7.1	29.7	8.7	29.7
24	7.4	29.5	7.0	29.5	9.0	29.5
25	6.8	29.5	7.2	29.7	9.1	29.3
26	7.0	29.3	7.4	29.4	8.8	29.5
27	7.0	29.4	7.6	29.8	9.2	29.5
28	6.7	29.5	7.5	29.7	8.2	29.0
29	6.8	29.4			8.1	29.4
30	6.6	29.4			8.3	29.4
31	6.8	29.3			7.9	29.3
MEANS	6.9	29.4	7.2	29.3	8.0	29.3
OBSVNS.	31	31	28	28	31	31
MAXIMUM	7.4	29.5	7.8	29.8	9.2	29.9
MINIMUM	6.6	29.1	6.1	27.1	6.8	26.4
STD.DEV.	.18	.13	.40	.51	.60	.66

CHROME ISLAND 49 28 20 N 124 40 57 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	8.3	29.1	11.8	26.7	14.8	28.8
2	8.4	29.3	12.8	29.8	16.5	29.0
3	8.2	29.1	12.5	29.5	16.8	29.4
4	9.3	29.4	11.3	30.0	14.9	28.6
5	9.3	29.3	11.2	29.5	15.5	29.3
6	9.5	29.4	9.8	30.3	15.1	29.0
7	9.3	29.3	9.9	30.6	15.5	29.0
8	9.2	29.8	11.0	30.7	15.8	29.0
9	9.1	29.9	11.5	29.7	16.3	29.0
10	9.1	29.8	11.1	29.5	16.2	29.1
11	9.6	29.8	12.0	29.8	15.0	29.3
12	8.0	30.0	11.0	29.9	13.4	29.4
13	8.4	29.9	12.6	29.8	15.9	30.0
14	8.5	29.9	12.6	30.0	13.5	29.1
15	8.8	30.0	11.8	29.5	13.8	28.8
16	8.1	29.8	11.0	29.5	13.8	28.9
17	8.3	29.7	12.3	29.3	14.2	28.9
18	8.4	29.5	12.0	28.6	14.6	29.0
19	8.3	29.5	12.8	28.0	14.6	29.1
20	9.0	30.0	12.5	29.1	14.7	28.5
21	9.7	29.4	14.0	29.9	15.3	27.7
22	10.7	29.4	14.6	29.0	14.5	28.8
23	10.8	29.7	12.2	29.5	13.0	29.3
24	11.3	29.7	12.5	29.7	14.7	28.2
25	11.4	29.7	13.7	29.3	17.0	26.9
26	11.3	29.5	12.0	30.3	16.8	26.0
27	12.3	29.1	10.4	30.2	17.0	25.4
28	12.5	29.0	12.9	29.7	17.5	25.5
29	12.0	29.4	12.5	29.8	17.8	25.9
30	10.6	29.8	12.8	29.3	14.0	27.6
31			13.8	28.8		
MEANS	9.6	29.6	12.1	29.5	15.3	28.4
OBSVNS.	30	30	31	31	30	30
MAXIMUM	12.5	30.0	14.6	30.7	17.8	30.0
MINIMUM	8.0	29.0	9.8	26.7	13.0	25.4
STD.DEV.	1.36	.30	1.13	.77	1.28	1.24

CHROME ISLAND 49 28 20 N 124 40 57 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	14.0	27.6	16.2	28.2	15.4	29.0
2	14.1	28.0	16.8	27.7	13.8	28.9
3	13.8	28.5	18.3	26.7	12.3	29.4
4	14.2	28.4	18.9	26.5	12.1	29.3
5	15.4	27.8	20.0	27.2	12.0	29.1
6	16.3	26.9	18.4	27.2	12.8	29.0
7	15.0	27.6	18.2	27.2	13.1	29.0
8	14.2	27.8	18.0	27.2	13.8	27.3
9	13.3	28.6	17.7	28.1	13.4	29.0
10	13.8	27.6	15.5	28.4	13.1	28.2
11	13.9	28.0	16.8	28.2	13.0	28.6
12	13.8	27.8	17.4	28.0	14.6	28.0
13	13.8	27.7	17.0	28.0	15.8	26.7
14	14.2	27.4	16.0	28.2	15.7	27.3
15	15.8	26.1	16.3	28.5	13.8	28.5
16	17.2	23.9	15.2	28.8	14.2	28.4
17	17.8	24.7	16.5	28.4	15.1	28.8
18	19.0	24.6	15.2	28.6	16.0	27.1
19	19.5	24.8	15.4	28.5	15.9	27.8
20	20.2	25.0	18.3	27.7	16.0	29.9
21	20.0	24.8	17.0	28.0	14.9	28.0
22	18.7	25.6	17.3	28.4	14.6	29.7
23	18.5	26.4	16.1	28.9	15.2	27.7
24	19.2	26.3	17.0	28.1	15.2	28.0
25	17.4	26.9	17.2	28.2	15.5	27.6
26	16.6	27.3	17.8	28.2	11.9	29.3
27	18.5	26.8	18.2	28.0	13.4	28.4
28	18.0	27.3	13.2	29.3	13.3	29.9
29	17.0	27.8	17.8	28.1	11.7	29.4
30	17.2	27.7	17.3	28.9	10.3	29.9
31	15.2	28.1	16.0	28.5		
MEANS	16.3	26.9	17.0	28.1	13.9	28.6
OBSVNS.	31	31	31	31	30	30
MAXIMUM	20.2	28.6	20.0	29.3	16.0	29.9
MINIMUM	13.3	23.9	13.2	26.5	10.3	26.7
STD.DEV.	2.21	1.32	1.34	.64	1.52	.88

CHROME ISLAND 49 26 20 N 124 40 57 W

	OCTOBER		NOVEMBER		DECEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	11.8	29.9	10.0	28.6	8.4	29.5
2	12.0	30.2	10.0	29.1	8.7	29.7
3	12.0	30.3	10.0	28.6	8.6	29.5
4	12.3	28.9	10.2	28.8	8.7	29.4
5	12.6	28.8	10.2	29.9	8.5	29.4
6	12.8	28.5	10.0	28.6	8.4	29.1
7	13.0	28.4	9.8	28.6	8.5	29.1
8	13.6	28.4	9.9	28.3	8.6	29.1
9	12.8	28.5	9.7	29.0	8.8	29.5
10	12.7	28.8	9.3	28.8	8.2	29.1
11	12.8	28.8	9.4	28.6	8.3	29.7
12	13.2	28.4	9.4	28.8	8.2	29.4
13	13.2	28.8	9.4	28.6	8.3	29.7
14	12.8	28.8	9.4	29.4	8.3	29.4
15	12.4	28.8	8.8	28.5	7.8	27.8
16	12.8	28.6	9.1	28.9	7.8	29.1
17	12.1	28.9	9.3	28.6	8.4	29.3
18	11.7	29.1	9.2	29.1	8.7	29.7
19	11.1	29.0	9.5	29.4	8.6	29.3
20	10.8	29.4	9.3	29.1	8.5	29.5
21	10.5	29.4	9.3	29.3	8.5	29.5
22	10.1	29.5	9.0	29.0	8.5	29.5
23	9.9	29.8	9.2	29.7	8.3	29.0
24	9.9	29.9	9.0	29.5	8.3	29.3
25	10.0	29.4	8.8	29.8	8.4	29.1
26	10.0	29.5	8.4	29.3	8.4	29.8
27	9.8	29.7	8.7	29.5	8.5	29.7
28	9.7	29.5	8.8	29.5	8.1	29.1
29	9.9	28.5	8.5	29.4	7.8	28.5
30	10.6	28.9	8.7	29.5	7.9	28.6
31	10.3	28.1			8.1	28.8
MEANS	11.6	29.1	9.3	29.1	8.4	29.3
OBSVNS.	31	31	30	30	31	31
YRLY.MEANS..					11.3	28.9
MAXIMUM	13.6	30.3	10.2	29.9	8.8	29.8
MINIMUM	9.7	28.1	8.4	28.3	7.8	27.8
STD.DEV.	1.29	.58	.51	.44	.27	.42

SISTERS ISLAND 49 29 13 N 124 26 00 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	5.9	29.7	6.5	29.9	6.7	29.7
2	6.6	29.7	6.6	29.9	6.8	29.7
3	6.7	29.7	6.4	29.8	7.1	30.0
4	7.0	29.7	6.8	30.0	7.3	29.8
5	6.6	29.5	6.8	29.9	7.6	29.8
6	6.6	29.3	6.9	29.9	7.9	29.8
7	6.7	29.7	6.9	29.9	7.5	29.8
8	* 6.6	* 29.4	7.1	29.8	7.4	29.8
9	6.4	29.1	7.1	29.8	7.0	29.8
10	6.6	29.5	7.0	29.9	6.8	29.9
11	6.4	29.4	7.2	29.8	7.4	29.8
12	6.5	29.5	7.1	29.9	7.4	30.0
13	6.7	29.7	7.2	30.0	7.4	30.0
14	6.7	29.3	6.7	29.5	7.4	29.9
15	6.1	29.0	7.2	29.8	7.6	29.9
16	6.4	29.0	7.2	29.8	7.6	29.7
17	6.9	29.3	7.2	29.7	7.4	29.9
18	6.7	29.4	7.0	29.7	7.8	29.8
19	6.9	29.4	6.8	29.5	7.7	29.7
20	7.2	29.4	6.9	29.4	8.3	29.4
21	6.9	29.1	6.7	29.8	8.1	29.7
22	7.1	29.5	6.8	29.4	9.2	27.2
23	7.1	29.4	6.7	29.4	9.2	27.4
24	6.9	29.4	7.2	29.5	9.2	29.3
25	7.1	29.3	7.5	29.5	9.0	28.9
26	6.9	29.1	7.3	29.7	9.1	28.6
27	7.1	29.4	6.9	29.7	8.5	28.9
28	8.1	29.7	6.9	29.5	8.1	28.9
29	* 7.3	* 29.8			8.8	28.9
30	6.4	29.9			8.2	28.9
31	6.5	29.9			7.9	29.1
MEANS	6.7	29.4	6.9	29.7	7.9	29.4
OBSVNS.	29	29	28	28	31	31
MAXIMUM	8.1	29.9	7.5	30.0	9.2	30.0
MINIMUM	5.9	29.0	6.4	29.4	6.7	27.2
STD.DEV.	.40	.25	.26	.19	.75	.70

SISTERS ISLAND 49 29 13 N 124 26 00 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	7.9	29.1	11.7	29.1	15.0	27.3
2	8.1	29.1	12.2	29.4	17.8	27.7
3	8.1	29.4	11.9	29.1	18.1	27.3
4	8.4	29.7	12.4	29.4	14.9	27.7
5	8.9	29.1	11.1	29.1	14.6	28.1
6	8.8	29.7	10.7	29.8	13.6	28.2
7	8.7	29.7	10.5	30.0	12.4	27.4
8	9.4	29.1	9.8	30.0	13.2	28.5
9	9.1	29.8	9.9	29.9	14.1	28.6
10	9.2	29.8	10.9	27.4	14.6	28.8
11	8.2	29.4	10.8	26.8	14.6	28.0
12	8.1	29.9	11.3	28.0	14.1	28.9
13	7.9	29.9	12.0	28.8	14.6	24.8
14	7.8	30.0	13.0	29.3	15.7	22.4
15	7.8	29.9	11.9	30.0	14.9	24.7
16	7.9	30.2	12.6	29.5	15.2	25.0
17	7.9	30.3	12.6	29.1	15.2	24.0
18	8.2	30.2	12.7	29.4	15.1	22.2
19	8.6	29.3	11.2	29.7	15.1	22.2
20	8.9	29.5	13.3	29.1	16.4	19.6
21	9.2	29.3	15.3	27.2	16.7	20.5
22	10.0	29.1	14.7	28.2	16.4	21.6
23	10.2	29.1	15.0	27.4	15.1	24.2
24	9.4	29.0	14.4	28.4	15.6	24.4
25	10.0	29.3	16.1	27.4	16.1	24.6
26	10.8	29.4	13.6	28.4	16.8	22.5
27	10.8	29.3	11.4	29.0	17.2	24.0
28	11.1	29.0	13.3	28.4	17.2	25.0
29	11.6	29.0	12.8	28.4	17.2	24.6
30	11.9	29.0	14.4	28.0	16.4	25.5
31			14.6	28.1		
MEANS	9.1	29.5	12.5	28.8	15.5	25.3
OBSVNS.	30	30	31	31	30	30
MAXIMUM	11.9	30.3	16.1	30.0	18.1	28.9
MINIMUM	7.8	29.0	9.8	26.8	12.4	19.6
STD.DEV.	1.20	.41	1.64	.91	1.36	2.66

SISTERS ISLAND 49 29 13 N 124 26 00 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	14.2	26.3	17.5	25.1	17.9	27.3
2	15.6	23.0	18.1	25.1	15.1	28.0
3	15.8	23.0	18.5	25.9	14.2	27.4
4	16.1	20.1	18.1	26.5	13.8	24.0
5	17.2	20.0	18.2	26.7	14.8	25.5
6	17.5	21.2	18.1	26.8	15.2	23.8
7	16.8	22.5	18.3	26.8	15.7	22.5
8	15.9	24.2	18.6	27.2	14.9	24.7
9	15.1	24.7	19.3	27.1	14.6	25.0
10	15.9	22.6	18.9	26.8	14.3	25.8
11	15.2	23.5	17.9	26.7	13.2	26.8
12	14.9	23.3	17.6	27.4	14.7	26.1
13	15.5	22.2	18.4	27.3	14.9	25.9
14	15.9	20.5	19.0	27.2	17.7	25.5
15	15.3	25.6	18.1	27.1	14.7	26.8
16	16.6	25.1	18.0	26.7	14.9	27.2
17	18.1	25.6	17.9	25.9	16.9	27.1
18	19.1	24.7	18.0	24.0	17.3	27.3
19	17.9	26.1	18.4	24.6	17.6	27.3
20	18.8	25.9	19.4	25.4	16.2	27.2
21	19.0	25.5	18.1	26.1	14.6	27.2
22	16.8	26.7	18.6	26.0	15.4	27.2
23	18.3	27.2	18.2	25.9	12.9	27.2
24	17.9	26.3	18.8	26.0	14.3	27.3
25	18.6	26.0	18.7	26.4	14.1	27.3
26	18.1	26.8	19.7	26.7	14.4	27.6
27	17.9	26.7	17.4	27.2	14.2	27.4
28	17.5	26.5	17.9	26.9	13.9	27.7
29	17.5	26.3	18.4	26.9	13.1	27.4
30	18.1	25.9	19.3	26.9	13.9	27.7
31	18.1	24.7	18.0	26.8		
MEANS	16.9	24.5	18.4	26.4	15.0	26.5
OBSVNS.	31	31	31	31	30	30
MAXIMUM	19.1	27.2	19.7	27.4	17.9	28.0
MINIMUM	14.2	20.0	17.4	24.0	12.9	22.5
STD.DEV.	1.37	2.12	.56	.84	1.35	1.35

SISTERS ISLAND 49 29 13 N 124 26 00 W

DATE	OCTOBER TEMP	OCTOBER SAL	NOVEMBER TEMP	NOVEMBER SAL	DECEMBER 1979 TEMP	DECEMBER 1979 SAL
1	13.9	27.3	10.0	28.0	8.3	28.8
2	13.6	27.4	9.9	27.7	8.2	28.6
3	13.6	27.4	10.1	27.7	8.3	28.5
4	13.3	27.8	9.9	28.0	8.3	28.6
5	13.6	27.6	10.1	27.7	8.3	28.9
6	14.1	27.4	9.8	28.1	8.5	28.6
7	13.9	27.3	9.6	27.8	8.5	28.6
8	13.9	27.2	9.7	28.1	8.6	28.9
9	13.3	27.2	9.7	28.1	8.3	28.6
10	13.2	27.6	9.4	27.7	8.5	28.9
11	13.5	27.4	9.4	28.4	8.1	28.9
12	13.6	27.4	9.4	28.2	7.9	28.8
13	13.5	27.4	9.3	28.2	8.1	28.8
14	13.0	27.8	9.1	28.4	7.9	28.9
15	13.3	28.0	9.1	28.4	8.2	28.8
16	13.1	27.8	9.2	28.1	7.6	29.0
17	12.8	28.0	9.5	28.1	9.1	28.8
18	12.4	28.5	9.1	28.2	8.2	29.0
19	11.9	28.5	9.2	28.4	8.4	29.3
20	12.1	28.5	9.1	28.5	8.2	29.3
21	11.0	29.0	8.9	28.8	8.2	28.8
22	10.7	28.9	9.2	28.6	7.4	29.0
23	10.4	29.4	9.0	29.1	7.6	28.2
24	10.7	28.8	8.9	29.5	8.1	28.9
25	10.7	28.4	8.8	29.5	8.0	28.6
26	10.4	29.0	8.4	29.3	7.6	27.8
27	10.3	28.8	8.2	29.7	7.8	28.4
28	10.4	28.4	7.8	28.2	7.5	27.7
29	10.4	28.0	7.9	28.4	7.5	27.8
30	10.6	27.7	8.3	28.5	7.4	27.3
31	10.1	27.7			7.6	28.1
MEANS	12.3	28.0	9.2	28.4	8.1	28.6
OBSVNS.	31	31	30	30	31	31
YRLY.MEANS..........					11.6	27.9
MAXIMUM	14.1	29.4	10.1	29.7	9.1	29.3
MINIMUM	10.1	27.2	7.8	27.7	7.4	27.3
STD.DEV.	1.43	.64	.62	.55	.41	.46

DEPARTURE BAY 49 12 38 N 123 57 17 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	*	*	5.4	29.28	6.0	26.21
2	7.0	29.60	5.4	29.66	5.9	26.86
3	7.4	29.60	* 6.0	* 29.72	* 6.4	* 26.36
4	7.1	29.58	* 6.6	* 29.79	* 6.9	* 25.86
5	7.2	29.59	7.2	29.86	7.4	25.36
6	* 7.1	* 29.57	6.9	29.35	7.9	* 27.35
7	* 7.0	* 29.54	7.1	29.76	8.0	29.35
8	6.9	29.51	6.9	28.44	8.0	28.78
9	6.9	29.29	*	*	8.5	28.22
10	6.1	29.04	*	*	* 8.5	* 28.56
11	6.3	29.46	*	*	* 8.4	* 28.90
12	6.7	29.33	6.5	26.71	8.3	29.24
13	* 6.6	* 29.39	7.1	27.01	8.6	28.37
14	* 6.5	* 29.46	7.1	29.98	7.5	28.60
15	6.4	29.52	4.8	26.16	7.8	28.42
16	6.5	29.63	5.7	27.21	7.8	28.90
17	6.5	29.06	* 5.7	* 27.48	* 7.6	* 29.16
18	6.6	29.49	* 5.8	* 27.75	* 7.4	* 29.42
19	6.9	29.53	5.9	28.02	7.2	29.68
20	* 6.9	* 29.58	6.1	27.88	8.0	27.50
21	* 6.9	* 29.64	* 5.8	* 28.10	8.4	26.70
22	6.9	29.69	5.5	28.32	8.7	27.07
23	6.8	28.47	5.9	27.82	9.5	26.58
24	6.8	29.04	* 6.4	* 27.70	* 9.4	* 26.58
25	7.5	29.86	* 6.9	* 27.57	* 9.3	* 26.59
26	6.8	29.48	7.4	27.44	9.2	26.59
27	* 6.5	* 29.47	6.4	24.36	9.5	28.97
28	* 6.2	* 29.45	5.9	24.49	8.5	28.86
29	5.9	29.43			8.1	28.95
30	6.4	29.64			8.1	29.13
31	6.3	29.70			* 8.1	* 29.09
MEANS	6.7	29.43	6.3	27.88	8.0	28.02
OBSVNS.	22	22	18	18	22	21
MAXIMUM	7.5	29.86	7.4	29.98	9.5	29.68
MINIMUM	5.9	28.47	4.8	24.36	5.9	25.36
STD.DEV.	.40	.304	.77	1.703	.91	1.234

DEPARTURE BAY 49 12 38 N 123 57 17 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	* 8.2	* 29.06	11.8	28.64	15.8	24.55
2	8.3	29.02	* 12.0	* 26.46	* 16.0	* 24.39
3	8.8	29.04	12.3	24.28	* 16.2	* 24.22
4	8.8	28.97	11.6	25.98	16.4	24.05
5	9.3	28.88	* 11.4	* 26.50	14.6	28.05
6	9.4	29.19	* 11.2	* 27.03	15.7	29.12
7	* 9.2	* 29.10	11.0	27.56	16.5	26.38
8	* 8.9	* 29.00	11.6	28.94	16.0	26.74
9	8.7	28.91	12.1	24.56	* 15.7	* 26.91
10	8.9	29.20	12.0	24.85	* 15.3	* 27.09
11	9.4	29.41	11.0	26.76	15.0	27.26
12	8.8	28.50	* 11.1	* 27.17	15.1	26.86
13	*	*	* 11.3	* 27.59	14.7	24.50
14	*	*	11.5	28.01	14.7	26.00
15	*	*	13.3	27.61	14.0	27.23
16	*	*	12.8	27.19	* 14.1	*
17	*	*	13.3	24.73	* 14.3	*
18	8.5	28.25	12.5	26.66	14.5	*
19	8.8	28.21	*	*	14.5	25.32
20	9.0	27.90	*	*	14.6	26.17
21	* 9.7	* 27.96	*	*	16.0	26.50
22	* 10.5	* 28.03	15.0	25.87	15.3	26.56
23	11.2	28.09	15.3	26.16	* 15.5	* 23.44
24	* 11.5	* 28.32	14.8	27.91	* 15.8	* 20.31
25	11.8	28.55	13.9	27.74	16.1	17.18
26	12.0	28.53	* 13.6	* 27.30	17.0	17.86
27	11.3	28.35	* 13.3	* 26.85	18.0	18.11
28	* 11.5	* 28.48	13.0	26.40	17.0	21.53
29	* 11.8	* 28.61	14.0	24.31	17.0	23.53
30	12.0	28.74	14.5	24.45	*	*
31			15.0	24.69		
MEANS	9.7	28.69	13.0	26.35	15.6	24.68
OBSVNS.	17	17	21	21	21	20
MAXIMUM	12.0	29.41	15.3	28.94	18.0	29.12
MINIMUM	8.3	27.90	11.0	24.28	14.0	17.18
STD.DEV.	1.34	.435	1.40	1.523	1.07	3.441

DEPARTURE BAY 49 12 38 N 123 57 17 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	*	*	18.5	22.33	*	*
2	*	*	19.0	20.68	*	*
3	14.7	27.63	19.5	21.09	*	*
4	16.3	24.82	*	*	13.2	28.38
5	16.5	23.36	*	*	13.7	28.39
6	18.3	24.28	*	*	12.0	28.93
7	* 17.2	* 25.12	18.3	26.09	13.9	24.91
8	* 16.1	* 25.97	17.3	24.97	*	*
9	14.9	26.82	17.9	25.21	*	*
10	16.9	19.55	18.5	25.17	*	*
11	15.3	21.93	* 18.6	* 25.39	15.3	22.69
12	12.0	27.93	* 18.8	* 25.62	15.9	23.14
13	13.8	26.47	18.9	25.84	16.1	23.34
14	* 15.0	* 24.44	18.2	26.34	16.9	23.47
15	* 16.2	* 22.41	14.5	27.66	* 16.7	* 24.35
16	17.4	20.37	*	*	* 16.5	* 25.24
17	20.3	20.96	*	*	16.3	26.13
18	* 19.6	24.04	*	*	17.0	25.51
19	18.9	24.31	*	*	17.0	25.61
20	18.8	*	18.7	21.88	16.5	25.71
21	* 18.7	*	* 18.6	* 21.47	14.5	26.99
22	* 18.6	*	18.5	21.06	* 14.6	* 26.73
23	18.5	25.83	14.8	27.28	* 14.8	* 26.46
24	17.5	26.01	15.1	27.81	15.0	26.19
25	17.8	26.02	* 16.3	* 26.99	15.1	26.21
26	17.8	26.00	* 17.6	* 26.17	15.0	26.26
27	18.4	26.05	18.8	25.35	14.5	26.51
28	* 17.5	* 26.50	17.1	26.48	12.6	28.22
29	* 16.5	* 26.96	18.4	26.01	* 12.5	* 28.31
30	15.5	27.42	18.0	26.09	* 12.3	* 28.41
31	15.3	27.81	16.9	27.16		
MEANS	16.7	24.89	17.7	24.97	15.0	25.92
OBSVNS.	20	20	19	19	18	18
MAXIMUM	20.3	27.93	19.5	27.81	17.0	28.93
MINIMUM	12.0	19.55	14.5	20.68	12.0	22.69
STD.DEV.	2.02	2.526	1.46	2.350	1.52	1.886

DEPARTURE BAY 49 12 38 N 123 57 17 W

DATE	OCTOBER TEMP	OCTOBER SAL	NOVEMBER TEMP	NOVEMBER SAL	DECEMBER 1979 TEMP	DECEMBER 1979 SAL
1	12.2	28.51	10.1	26.45	*	*
2	14.2	26.57	10.1	26.71	*	*
3	15.0	25.48	* 10.1	* 27.02	7.8	26.97
4	14.5	26.06	* 10.1	* 27.34	8.3	28.54
5	14.4	26.49	10.1	27.66	7.7	28.32
6	*	*	10.0	28.33	8.4	26.77
7	*	*	9.7	28.01	7.9	27.84
8	*	*	9.5	28.04	* 7.9	* 28.21
9	13.9	26.48	9.5	27.94	* 7.9	* 28.58
10	13.9	26.63	*	*	7.9	28.95
11	14.0	26.91	*	*	7.0	28.44
12	13.7	27.11	*	*	7.8	28.77
13	* 13.5	* 27.07	8.9	27.88	7.5	27.26
14	* 13.2	* 27.02	* 8.9	27.87	7.7	28.77
15	12.9	26.98	* 9.0	27.95	* 7.7	* 25.84
16	12.9	27.03	9.0	27.76	* 7.6	* 22.91
17	12.5	27.57	* 9.0	* 27.90	7.5	19.98
18	12.2	27.57	* 8.9	* 28.05	7.9	19.32
19	11.0	28.42	8.9	28.20	8.4	17.88
20	* 10.8	* 28.43	8.9	28.43	7.8	21.39
21	* 10.5	* 28.45	* 8.8	* 28.37	7.8	19.83
22	10.3	28.47	8.7	28.30	* 7.4	* 20.22
23	10.0	29.24	8.4	28.45	* 6.9	* 20.62
24	9.9	29.35	* 8.4	* 28.35	6.5	21.02
25	9.2	26.19	* 8.3	* 28.24	* 6.7	* 22.22
26	9.9	23.28	8.3	28.14	* 7.0	* 23.42
27	* 9.9	* 25.10	8.1	27.86	7.2	24.62
28	* 9.9	* 26.93	7.7	27.93	7.4	26.22
29	9.9	28.75	7.2	27.77	* 7.4	* 25.89
30	10.1	28.35	*	*	* 7.4	* 25.55
31	10.9	26.56			7.4	25.22
MEANS	12.2	27.18	9.0	27.88	7.7	25.06
OBSVNS.	22	22	17	19	19	19
YRLY.MEANS.....................................					11.5	26.76
MAXIMUM	15.0	29.35	10.1	28.45	8.4	28.95
MINIMUM	9.2	23.28	7.2	26.45	6.5	17.88
STD.DEV.	1.89	1.389	.88	.512	.47	3.837

ENTRANCE ISLAND 49 12 34 N 123 48 27 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	7.1	29.0	6.9	29.1	6.8	28.5
2	7.2	29.1	6.8	29.1	6.8	28.9
3	7.3	29.0	7.1	29.3	6.9	28.9
4	7.2	29.0	7.2	29.4	7.1	28.9
5	7.2	29.1	7.4	29.4	7.2	28.5
6	7.2	29.1	7.2	29.4	7.2	28.8
7	7.2	29.1	7.6	29.4	7.6	26.7
8	7.2	29.0	7.4	29.4	7.7	27.2
9	7.1	29.0	7.5	29.4	7.8	28.2
10	7.0	29.0	7.6	29.5	7.9	26.8
11	7.2	29.1	7.6	28.9	7.6	28.4
12	6.8	28.9	7.9	29.8	7.8	30.0
13	6.9	29.0	7.9	29.7	8.4	26.5
14	7.2	29.1	7.7	29.3	7.8	28.0
15	6.9	29.0	7.4	29.7	7.7	28.9
16	7.2	29.1	* 7.6	* 29.8	7.7	28.6
17	7.2	29.1	7.9	29.9	7.6	29.0
18	7.2	29.1	7.7	29.5	7.5	29.1
19	7.2	29.0	7.1	28.2	7.6	29.1
20	7.6	29.1	7.4	29.0	7.6	28.6
21	7.7	29.4	7.1	29.3	8.2	26.9
22	7.3	29.0	6.9	28.8	8.3	26.8
23	7.2	29.3	6.4	28.2	8.9	27.1
24	7.3	29.4	7.1	29.1	9.0	26.8
25	7.6	29.3	7.7	29.5	8.9	27.6
26	7.3	29.4	7.5	28.5	8.6	28.2
27	7.4	29.5	7.1	28.8	8.6	28.4
28	7.1	29.1	6.9	29.1	8.2	28.5
29	7.2	29.3			8.1	28.4
30	6.8	29.3			7.9	28.1
31	6.6	29.3			7.8	28.2
MEANS	7.2	29.1	7.3	29.2	7.8	28.1
OBSVNS.	31	31	27	27	31	31
MAXIMUM	7.7	29.5	7.9	29.9	9.0	30.0
MINIMUM	6.6	28.9	6.4	28.2	6.8	26.5
STD.DEV.	.23	.16	.37	.43	.59	.89

ENTRANCE ISLAND 49 12 34 N 123 48 27 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	7.9	28.4	11.4	28.2	15.9	24.2
2	7.9	28.6	11.8	28.4	16.0	24.2
3	8.4	28.4	11.0	28.2	17.8	24.0
4	8.4	28.6	10.0	28.9	16.6	24.4
5	9.1	28.2	8.8	29.0	14.8	28.2
6	8.6	28.6	9.0	29.0	14.0	27.2
7	8.6	28.8	9.6	29.0	14.3	26.3
8	8.4	28.9	8.9	29.1	14.1	26.1
9	8.3	28.9	9.2	28.9	14.4	26.0
10	7.9	29.1	10.9	24.6	14.4	27.1
11	7.8	29.0	10.3	26.7	14.4	26.9
12	8.3	29.0	11.2	26.5	14.4	26.9
13	7.7	29.3	11.5	27.4	14.4	25.2
14	7.7	28.8	12.1	27.7	14.6	25.2
15	7.6	28.9	12.4	27.6	14.2	26.7
16	7.7	29.1	12.5	26.9	12.8	25.5
17	8.2	28.0	13.7	22.2	12.3	28.1
18	8.2	28.0	13.0	26.4	13.8	27.3
19	8.0	27.2	13.3	25.0	14.9	23.8
20	8.6	27.7	13.9	23.1	13.9	28.2
21	9.6	28.0	15.6	24.8	13.6	28.0
22	9.9	26.5	14.2	24.7	14.6	27.2
23	9.4	27.1	13.7	25.5	14.3	25.6
24	9.9	27.3	12.7	26.9	14.2	28.4
25	10.0	27.2	12.7	27.1	15.6	18.7
26	10.3	27.6	11.6	29.0	16.6	18.4
27	10.4	28.0	11.8	28.8	17.3	18.7
28	11.2	27.7	13.1	26.4	15.6	24.2
29	9.9	28.1	13.6	23.3	16.4	23.3
30	10.1	28.2	14.4	23.4	12.8	28.4
31			14.6	23.9		
MEANS	8.8	28.2	12.0	26.7	14.8	25.4
OBSVNS.	30	30	31	31	30	30
MAXIMUM	11.2	29.3	15.6	29.1	17.8	28.4
MINIMUM	7.6	26.5	8.8	22.2	12.3	18.4
STD.DEV.	1.01	.71	1.83	2.09	1.30	2.77

ENTRANCE ISLAND 49 12 34 N 123 48 27 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	13.9	25.1	18.1	22.0	14.3	28.4
2	13.6	26.7	19.1	20.8	12.7	28.5
3	14.2	27.3	17.8	22.4	12.7	28.6
4	* 15.5	* 26.1	18.6	24.0	12.7	28.5
5	16.9	24.8	19.3	24.0	12.2	28.4
6	18.3	18.3	18.3	25.6	13.7	27.3
7	15.9	25.0	18.7	23.9	14.6	25.5
8	13.7	27.1	19.3	22.6	11.8	28.5
9	15.6	25.9	19.2	23.9	13.3	28.4
10	12.8	27.7	18.1	25.9	14.5	25.4
11	12.7	29.1	18.5	26.3	14.6	23.4
12	14.6	26.4	18.4	24.4	15.6	23.8
13	15.3	25.5	18.4	24.8	* 16.6	* 23.7
14	15.4	19.2	13.6	28.5	17.7	23.5
15	16.9	17.3	14.7	28.1	15.6	25.1
16	17.8	20.8	18.1	26.4	15.4	25.8
17	18.3	21.6	16.0	27.2	15.9	25.5
18	18.2	23.0	15.8	26.7	16.0	25.5
19	18.1	24.6	16.7	25.8	16.7	25.4
20	19.4	24.3	18.5	20.5	16.1	25.5
21	18.1	25.0	18.9	20.5	14.8	26.4
22	18.4	25.1	15.6	28.6	15.9	25.4
23	17.3	25.4	16.9	26.1	15.4	25.5
24	17.4	25.4	16.9	27.2	15.3	25.9
25	20.2	24.8	19.3	22.0	15.2	26.0
26	19.4	25.2	19.0	24.4	15.1	26.1
27	17.7	24.4	17.2	25.9	13.7	26.7
28	15.8	26.8	15.8	26.7	12.8	28.4
29	16.3	26.4	18.5	21.6	11.8	28.5
30	16.0	24.7	17.8	25.0	11.7	28.5
31	16.3	25.4	15.2	28.9		
MEANS	16.5	24.6	17.6	24.9	14.4	26.5
OBSVNS.	30	30	31	31	29	29
MAXIMUM	20.2	29.1	19.3	28.9	17.7	28.6
MINIMUM	12.7	17.3	13.6	20.5	11.7	23.4
STD.DEV.	2.02	2.71	1.52	2.43	1.61	1.66

ENTRANCE ISLAND 49 12 34 N 123 48 27 W

	OCTOBER		NOVEMBER		DECEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	12.2	28.8	10.4	26.8	9.0	28.8
2	13.4	27.8	10.4	26.5	8.6	28.4
3	14.6	25.5	10.2	26.5	8.6	28.4
4	14.6	26.4	10.4	27.2	8.4	28.0
5	14.2	27.3	10.9	27.6	8.5	28.2
6	14.8	27.2	10.0	27.8	8.4	28.1
7	14.6	25.8	9.8	27.3	8.2	27.3
8	13.8	27.3	9.3	27.3	8.5	28.4
9	13.7	27.1	9.3	27.3	8.8	28.6
10	14.0	27.4	9.4	27.7	8.2	28.6
11	13.8	27.4	9.6	27.7	8.2	28.2
12	13.5	27.3	9.4	27.4	8.1	28.2
13	12.9	27.7	9.3	27.4	8.3	28.4
14	12.7	27.8	9.2	27.6	8.2	28.4
15	12.5	27.3	8.6	27.3	7.1	24.4
16	12.7	27.3	9.6	27.7	7.9	28.4
17	11.9	27.3	9.7	28.5	8.6	28.6
18	11.6	28.5	8.9	27.8	8.5	28.8
19	10.6	28.5	9.3	28.6	8.3	28.4
20	10.3	28.4	9.3	28.8	8.8	29.4
21	11.0	28.4	9.1	28.9	8.1	27.3
22	9.6	28.9	9.3	29.7	7.2	25.2
23	9.8	29.0	9.2	29.7	7.6	27.2
24	9.9	28.2	9.1	29.5	8.8	29.3
25	9.7	29.0	8.6	29.0	8.7	29.3
26	9.9	29.1	8.2	28.0	8.8	29.1
27	9.7	19.7	7.9	27.7	8.6	28.2
28	9.6	26.0	7.6	27.4	8.7	28.8
29	10.1	27.6	8.1	28.0	7.2	25.9
30	9.9	28.2	8.7	28.4	6.9	25.5
31	10.8	26.4			7.9	27.7
MEANS	12.0	27.4	9.3	27.9	8.2	28.0
OBSVNS.	31	31	30	30	31	31
YRLY.MEANS..					11.3	27.2
MAXIMUM	14.8	29.1	10.9	29.7	9.0	29.4
MINIMUM	9.6	19.7	7.6	26.5	6.9	25.2
STD.DEV.	1.86	1.71	.77	.86	.55	1.01

WEST VANCOUVER 49 20 18 N 123 14 06 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	*	*	*	*	*	*
2	*	*	*	*	*	*
3	*	*	*	*	*	*
4	*	*	*	*	*	*
5	*	*	*	*	*	*
6	*	*	*	*	*	*
7	*	*	*	*	*	*
8	*	*	*	*	*	*
9	*	*	*	*	*	*
10	*	*	*	*	*	*
11	*	*	*	*	*	*
12	*	*	*	*	*	*
13	*	*	*	*	*	*
14	*	*	*	*	*	*
15	*	*	*	*	*	*
16	*	*	*	*	*	*
17	*	*	*	*	*	*
18	*	*	*	*	*	*
19	*	*	*	*	*	*
20	*	*	*	*	*	*
21	*	*	*	*	*	*
22	*	*	*	*	*	*
23	*	*	*	*	*	*
24	*	*	*	*	*	*
25	*	*	*	*	*	*
26	*	*	*	*	*	*
27	*	*	*	*	*	*
28	*	*	*	*	*	*
29	*	*			*	*
30	*	*			*	*
31	*	*			*	*
MEANS	0.0	0.0	0.0	0.0	0.0	0.0
OBSVNS.	0	0	0	0	0	0
MAXIMUM	0.0	0.0	0.0	0.0	0.0	0.0
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0
STD.DEV.	0.00	0.00	0.00	0.00	0.00	0.00

WEST VANCOUVER 49 20 18 N 123 14 06 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	*	*	*	*	*	*
2	*	*	*	*	*	*
3	*	*	*	*	*	*
4	*	*	*	*	*	*
5	*	*	*	*	*	*
6	*	*	*	*	*	*
7	*	*	*	*	*	*
8	*	*	*	*	*	*
9	*	*	*	*	*	*
10	*	*	*	*	*	*
11	*	*	*	*	*	*
12	*	*	*	*	*	*
13	*	*	*	*	*	*
14	*	*	*	*	*	*
15	*	*	*	*	*	*
16	*	*	*	*	*	*
17	*	*	*	*	*	*
18	*	*	*	*	*	*
19	*	*	*	*	*	*
20	*	*	*	*	*	*
21	*	*	*	*	*	*
22	*	*	*	*	*	*
23	*	*	*	*	*	*
24	*	*	*	*	*	*
25	*	*	*	*	*	*
26	*	*	*	*	*	*
27	*	*	*	*	*	*
28	*	*	*	*	*	*
29	*	*	*	*	*	*
30	*	*	*	*	*	*
31			*	*		
MEANS	0.0	0.0	0.0	0.0	0.0	0.0
OBSVNS.	0	0	0	0	0	0
MAXIMUM	0.0	0.0	0.0	0.0	0.0	0.0
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0
STD.DEV.	0.00	0.00	0.00	0.00	0.00	0.00

WEST VANCOUVER 49 20 18 N 123 14 06 W

	JULY		AUGUST		SEPTEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	*	*	*	*	*	*
2	*	*	*	*	*	*
3	*	*	*	*	*	*
4	*	*	*	*	*	*
5	*	*	*	*	*	*
6	*	*	*	*	*	*
7	*	*	*	*	*	*
8	*	*	*	*	*	*
9	*	*	*	*	*	*
10	*	*	*	*	*	*
11	*	*	*	*	*	*
12	*	*	*	*	*	*
13	*	*	*	*	*	*
14	*	*	*	*	*	*
15	*	*	*	*	*	*
16	*	*	*	*	*	*
17	*	*	*	*	*	*
18	*	*	*	*	*	*
19	*	*	*	*	*	*
20	*	*	*	*	*	*
21	*	*	*	*	*	*
22	*	*	*	*	*	*
23	*	*	*	*	*	*
24	*	*	*	*	*	*
25	*	*	*	*	*	*
26	*	*	*	*	*	*
27	*	*	*	*	*	*
28	*	*	*	*	*	*
29	*	*	*	*	*	*
30	*	*	*	*	*	*
31	*	*	*	*		
MEANS	0.0	0.0	0.0	0.0	0.0	0.0
OBSVNS.	0	0	0	0	0	0
MAXIMUM	0.0	0.0	0.0	0.0	0.0	0.0
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0
STD.DEV.	0.00	0.00	0.00	0.00	0.00	0.00

WEST VANCOUVER 49 20 18 N 123 14 06 W

DATE	OCTOBER TEMP	OCTOBER SAL	NOVEMBER TEMP	NOVEMBER SAL	DECEMBER 1979 TEMP	DECEMBER 1979 SAL
1	*	*	*	*	*	*
2	*	*	*	*	*	*
3	*	*	*	*	8•1	*
4	*	*	*	*	8•9	*
5	*	*	*	*	8•6	*
6	*	*	*	*	8•2	*
7	*	*	*	*	8•5	*
8	*	*	*	*	9•7	*
9	*	*	*	*	8•3	*
10	*	*	*	*	7•9	*
11	*	*	*	*	8•1	*
12	*	*	*	*	8•0	*
13	*	*	*	*	7•9	*
14	*	*	*	*	7•7	*
15	*	*	*	*	7•5	*
16	*	*	*	*	8•5	*
17	*	*	*	*	8•7	*
18	*	*	*	*	8•3	*
19	*	*	*	*	8•2	*
20	*	*	*	*	7•9	*
21	*	*	*	*	7•1	*
22	*	*	*	*	7•6	*
23	*	*	*	*	8•5	*
24	*	*	*	*	6•8	*
25	*	*	*	*	7•0	*
26	*	*	*	*	7•1	*
27	*	*	*	*	8•2	*
28	*	*	*	*	6•9	*
29	*	*	*	*	8•0	*
30	*	*	*	*	7•8	*
31	*	*			8•2	*
MEANS	0•0	0•0	0•0	0•0	8•0	0•0
OBSVNS•	0	0	0	0	29	0
YRLY•MEANS•••						
MAXIMUM	0•0	0•0	0•0	0•0	9•7	0•0
MINIMUM	0•0	0•0	0•0	0•0	6•8	0•0
STD•DEV•	0•00	0•00	0•00	0•00	•64	0•00

ACTIVE PASS 48 52 26 N 123 17 23 W

	JANUARY		FEBRUARY		MARCH	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	5.6	27.4	5.2	29.4	6.9	29.9
2	5.8	27.3	5.9	29.0	6.8	30.3
3	5.6	28.6	6.3	29.5	7.1	29.8
4	5.6	29.1	6.6	30.6	7.3	29.8
5	5.8	29.3	6.9	29.9	7.8	30.3
6	5.1	28.4	6.8	29.9	7.9	30.2
7	5.6	28.5	6.1	28.0	7.6	27.4
8	6.1	29.4	7.4	29.1	7.3	27.6
9	6.1	29.7	7.6	29.3	7.4	23.8
10	6.2	28.8	7.1	30.3	8.1	27.7
11	6.8	29.0	7.2	30.3	7.8	30.7
12	7.0	29.7	7.3	29.9	7.9	27.8
13	6.8	29.7	7.1	30.3	8.1	27.2
14	6.3	29.7	6.1	30.2	7.9	29.8
15	6.2	29.5	6.3	29.7	7.4	30.3
16	6.4	29.8	6.7	30.0	7.4	30.0
17	6.7	29.8	6.9	30.3	7.3	29.9
18	6.9	29.9	6.8	29.9	7.8	29.7
19	6.9	29.9	6.5	30.2	8.7	26.9
20	7.0	29.7	6.8	28.6	8.2	27.2
21	* 6.7	* 28.9	6.2	26.5	8.0	26.7
22	6.3	28.0	6.2	28.4	8.3	27.7
23	6.8	29.4	6.2	28.2	8.7	28.0
24	6.3	28.9	7.2	29.8	9.0	28.4
25	5.7	28.0	7.8	30.4	8.9	28.0
26	6.1	29.8	7.8	30.4	8.8	29.4
27	6.1	29.0	7.5	29.9	* 8.8	* 28.6
28	6.2	28.8	7.6	30.7	8.8	27.8
29	6.2	29.7			8.4	28.9
30	5.4	29.5			8.0	28.8
31	5.2	29.0			8.2	28.1
MEANS	6.2	29.1	6.8	29.6	7.9	28.6
OBSVNS.	30	30	28	28	30	30
MAXIMUM	7.0	29.9	7.8	30.7	9.0	30.7
MINIMUM	5.1	27.3	5.2	26.5	6.8	23.8
STD.DEV.	.55	.73	.64	.95	.60	1.52

ACTIVE PASS 48 52 26 N 123 17 23 W

	APRIL		MAY		JUNE	1979
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	8.3	28.8	9.7	29.1	14.5	22.5
2	8.3	28.8	12.0	24.3	15.4	24.0
3	8.1	28.2	10.2	27.8	18.6	10.5
4	9.0	29.5	10.7	29.7	* 16.7	* 18.4
5	9.3	29.3	9.6	29.9	14.7	26.4
6	10.1	29.5	10.2	30.7	15.6	17.0
7	9.8	29.8	10.7	30.4	16.8	16.6
8	9.1	29.4	12.2	28.5	14.9	24.2
9	9.1	30.2	13.3	17.1	14.9	23.8
10	9.2	29.3	11.3	26.0	14.9	24.4
11	9.3	27.4	10.3	28.5	11.7	30.4
12	8.2	29.5	10.1	29.3	12.9	29.4
13	8.6	31.0	10.3	29.8	12.2	28.2
14	8.8	30.4	9.7	30.7	11.7	30.4
15	8.4	28.0	9.9	29.1	12.2	28.4
16	8.2	28.8	10.7	28.4	12.0	29.1
17	8.1	28.6	10.6	28.1	12.2	29.1
18	7.9	28.6	10.6	28.0	13.1	29.7
19	8.7	29.1	12.8	13.5	12.7	27.7
20	9.6	29.5	12.9	25.1	12.6	29.4
21	9.7	29.4	12.7	28.2	12.7	29.8
22	10.1	26.3	12.9	27.7	12.3	30.4
23	10.2	29.8	12.6	29.1	11.9	30.3
24	10.2	29.9	11.7	29.5	17.6	14.1
25	10.5	28.4	12.1	29.8	17.3	19.7
26	10.2	30.4	12.3	30.0	18.6	19.1
27	10.7	28.5	11.1	29.1	13.3	28.8
28	10.3	29.8	12.5	23.5	13.3	28.5
29	10.1	30.4	12.6	24.7	12.7	28.4
30	9.9	29.9	12.1	25.1	12.5	29.9
31			13.9	21.0		
MEANS	9.3	29.2	11.4	27.2	14.0	25.5
OBSVNS.	30	30	31	31	29	29
MAXIMUM	10.7	31.0	13.9	30.7	18.6	30.4
MINIMUM	7.9	26.3	9.6	13.5	11.7	10.5
STD.DEV.	.85	.97	1.24	3.95	2.12	5.52

ACTIVE PASS 48 52 26 N 123 17 23 W

DATE	JULY TEMP	JULY SAL	AUGUST TEMP	AUGUST SAL	SEPTEMBER 1979 TEMP	SEPTEMBER 1979 SAL
1	12.1	28.1	15.2	27.2	12.4	29.5
2	12.3	27.1	17.1	22.6	12.6	29.1
3	13.8	30.3	19.5	20.1	12.4	29.7
4	14.4	26.4	19.6	20.4	11.8	29.7
5	14.9	24.7	19.1	23.7	11.3	30.0
6	14.1	26.0	18.8	24.4	* 11.7	* 29.4
7	13.3	28.9	19.0	22.4	12.1	28.8
8	13.8	29.7	19.3	24.3	11.1	29.9
9	15.4	22.0	16.1	26.5	11.8	29.5
10	11.1	29.7	15.4	27.1	13.1	25.9
11	11.1	29.4	14.6	26.5	14.0	22.4
12	11.6	29.5	14.0	28.0	14.6	22.6
13	11.7	29.5	13.6	28.6	16.6	21.2
14	15.7	21.6	13.1	28.9	15.4	24.7
15	17.6	14.6	12.7	29.1	14.6	26.4
16	17.5	16.9	13.7	28.8	15.4	25.9
17	18.9	21.8	13.7	27.8	16.4	21.6
18	20.8	12.6	12.7	28.9	17.7	20.1
19	19.5	21.3	14.1	26.9	14.6	25.8
20	20.5	19.6	18.3	18.2	13.4	26.9
21	19.1	23.9	15.7	23.9	15.7	23.4
22	18.4	18.6	12.7	29.7	14.4	25.8
23	17.9	23.5	12.3	29.5	14.5	25.6
24	18.5	20.9	12.7	29.0	14.9	25.4
25	17.0	26.4	16.4	24.0	14.6	25.9
26	16.3	26.9	14.1	27.4	14.8	26.5
27	14.3	26.9	12.8	28.1	12.9	27.7
28	13.8	27.6	14.2	27.7	12.9	28.4
29	13.4	28.4	16.3	19.1	12.4	28.8
30	14.1	30.0	15.2	24.6	12.7	28.8
31	14.9	27.7	14.7	29.3		
MEANS	15.4	24.9	15.4	25.9	13.8	26.4
OBSVNS.	31	31	31	31	29	29
MAXIMUM	20.8	30.3	19.6	29.7	17.7	30.0
MINIMUM	11.1	12.6	12.3	18.2	11.1	20.1
STD.DEV.	2.85	4.78	2.38	3.30	1.68	2.93

ACTIVE PASS 48 52 26 N 123 17 23 W

	OCTOBER		NOVEMBER		DECEMBER 1979	
DATE	TEMP	SAL	TEMP	SAL	TEMP	SAL
1	12.7	27.6	10.0	27.2	8.3	29.7
2	14.1	22.5	9.3	25.0	8.2	28.5
3	13.4	25.5	9.6	28.6	8.4	26.3
4	13.6	25.5	10.1	26.9	8.4	26.9
5	13.2	26.1	9.9	28.5	8.6	28.2
6	12.8	27.1	9.6	27.2	8.4	28.2
7	12.2	27.7	9.3	24.3	8.8	29.3
8	* 12.4	* 26.4	8.8	23.8	8.9	29.4
9	12.7	25.0	9.2	25.6	8.9	29.5
10	13.3	25.8	8.8	25.4	* 8.7	* 29.0
11	12.0	28.1	8.7	24.7	8.5	28.5
12	12.1	28.0	8.7	25.4	7.8	31.4
13	12.1	29.1	8.8	27.1	8.3	29.1
14	12.3	27.3	8.7	27.7	8.4	29.7
15	12.3	27.3	8.7	26.8	7.7	29.4
16	12.5	27.6	8.7	26.4	6.9	29.1
17	12.8	27.2	8.6	27.7	8.8	29.9
18	10.7	29.8	8.3	27.2	8.6	29.8
19	11.1	30.3	9.6	29.7	8.8	30.0
20	10.5	29.3	9.4	29.3	9.0	31.1
21	10.4	29.5	9.1	29.9	8.6	30.3
22	10.1	30.4	9.3	30.7	7.7	29.8
23	10.1	30.4	9.4	30.2	7.9	29.9
24	10.1	30.3	9.4	29.8	8.3	31.0
25	10.1	29.7	8.6	29.5	8.4	30.4
26	10.2	31.0	8.4	28.6	8.5	30.7
27	9.8	30.4	8.1	28.4	8.1	30.2
28	9.9	30.2	7.8	28.0	7.9	29.3
29	10.0	29.5	8.5	29.5	8.2	30.0
30	10.1	25.5	8.8	29.7	7.1	24.7
31	9.9	23.1			8.2	28.9
MEANS	11.6	27.9	9.0	27.6	8.3	29.3
OBSVNS.	30	30	30	30	30	30
YRLY.MEANS..					10.8	27.6
MAXIMUM	14.1	31.0	10.1	30.7	9.0	31.4
MINIMUM	9.8	22.5	7.8	23.8	6.9	24.7
STD.DEV.	1.38	2.26	.56	1.92	.50	1.41

Annual Graphs of the 7-day

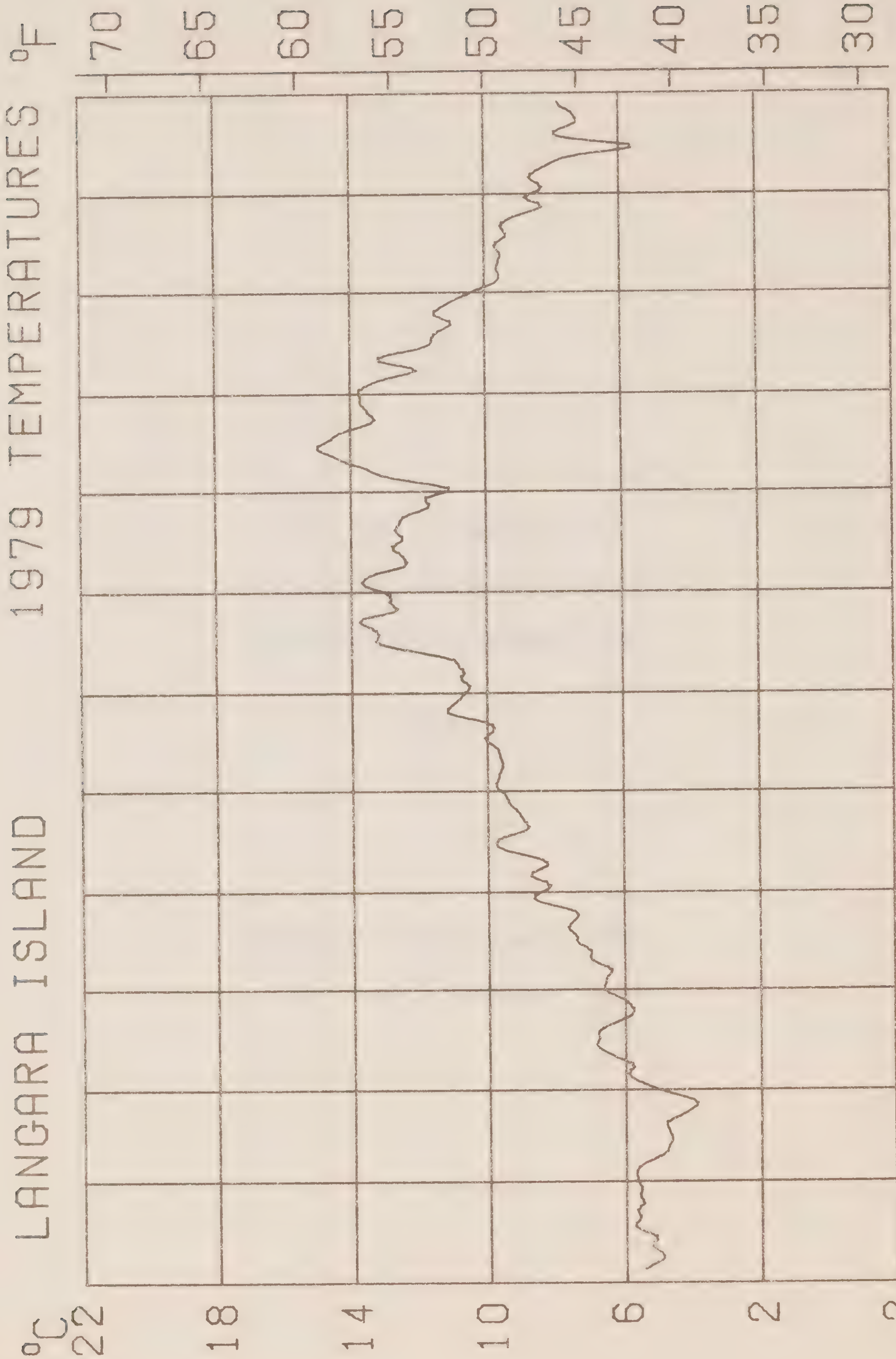
Normally-Weighted Running Means

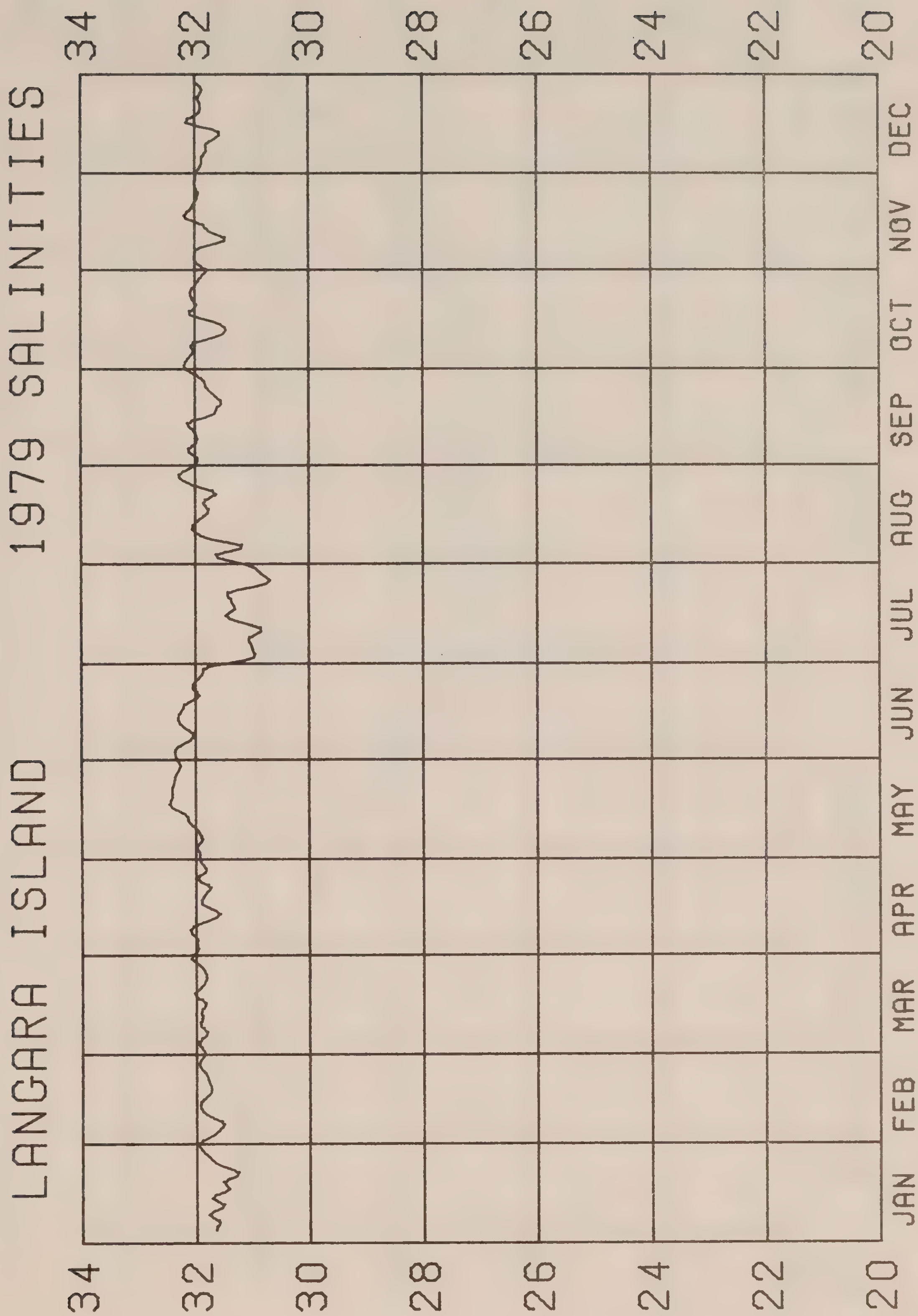
for Temperature and Salinity

1979

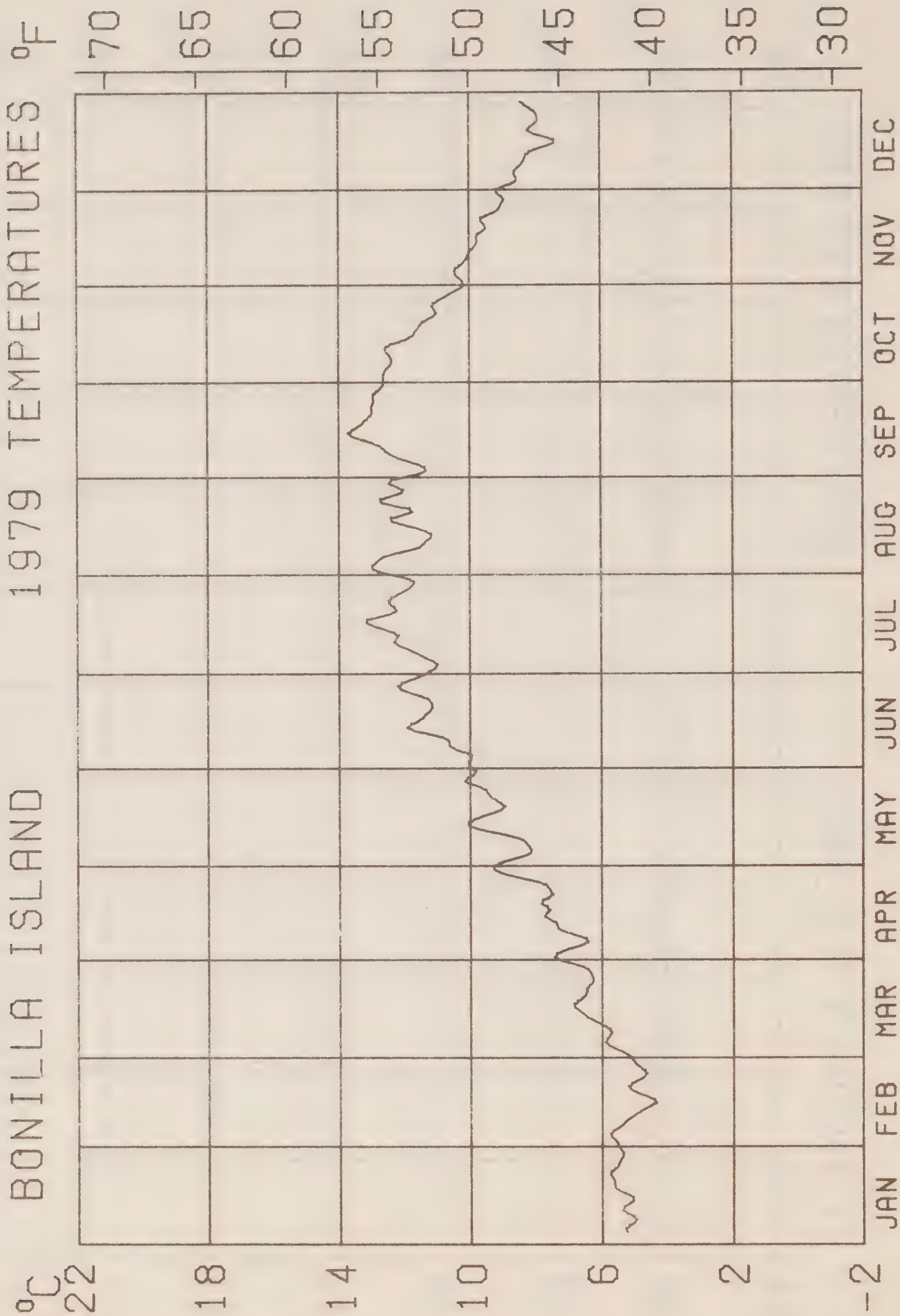
TEMP: Temperature (^{o}C and ^{o}F)

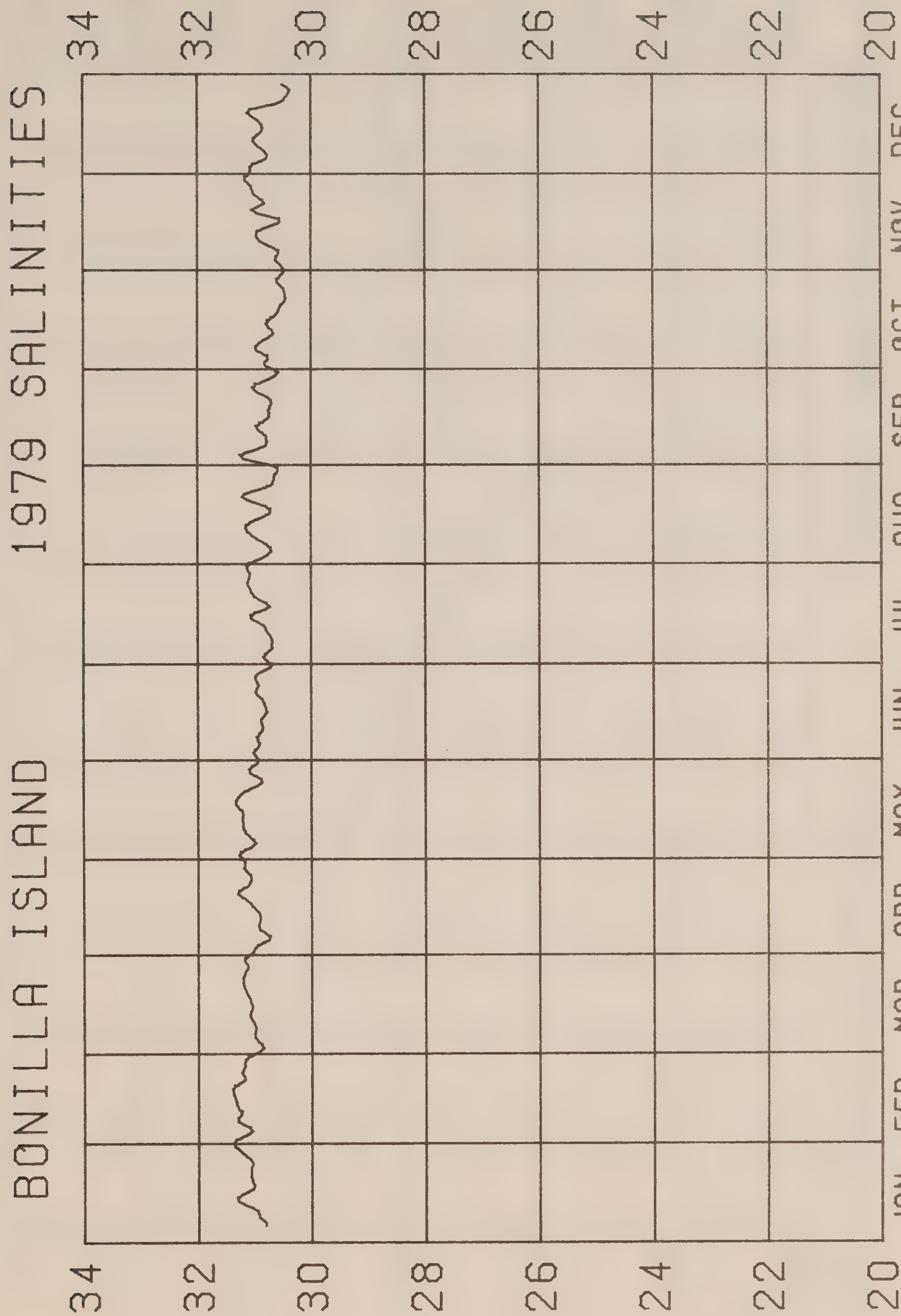
SAL: Salinity ($^{o}/oo$)


LANGARA ISLAND
1979 TEMPERATURES
°F
70
65
60
55
50
45
40
35
30
°C
22
18
14
10
6
2
-2
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC



LANGARA ISLAND 1979 SALINITIES
34
32
30
28
26
24
22
20
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


BONILLA ISLAND 1979 TEMPERATURES
°C
22
18
14
10
6
2
-2
°F
70
65
60
55
50
45
40
35
30
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


BONILLA ISLAND
1979 SALINITIES
34
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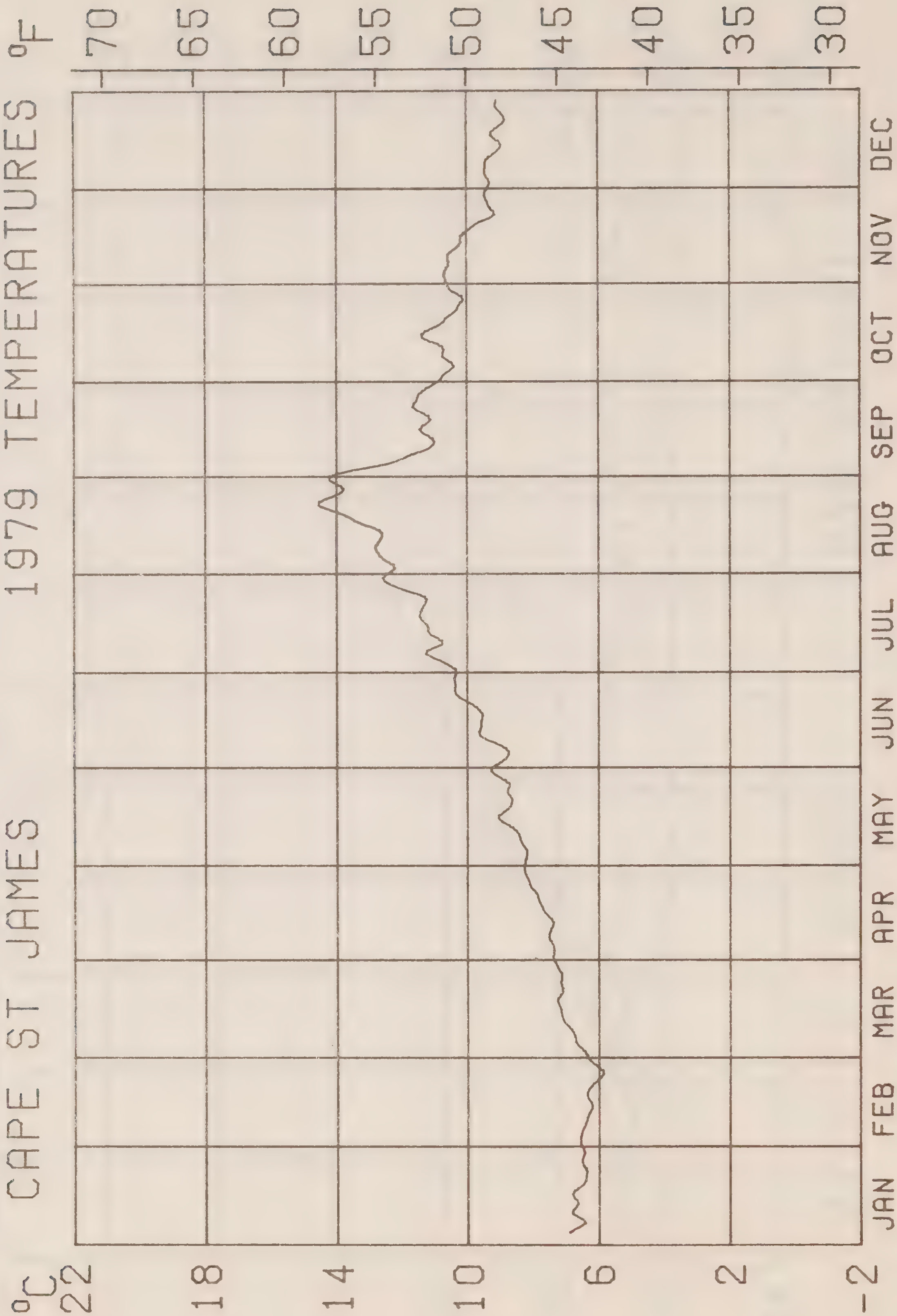
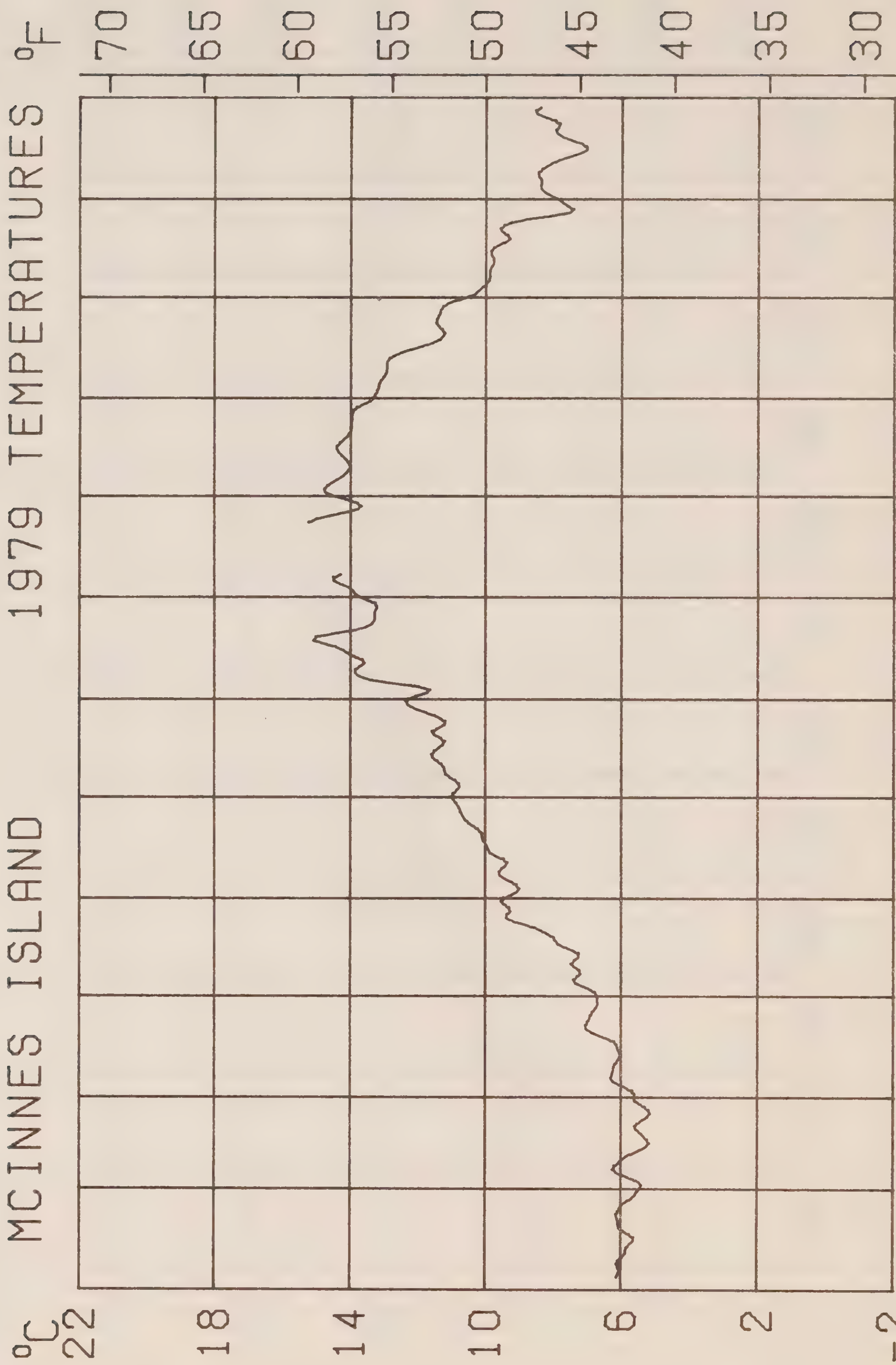
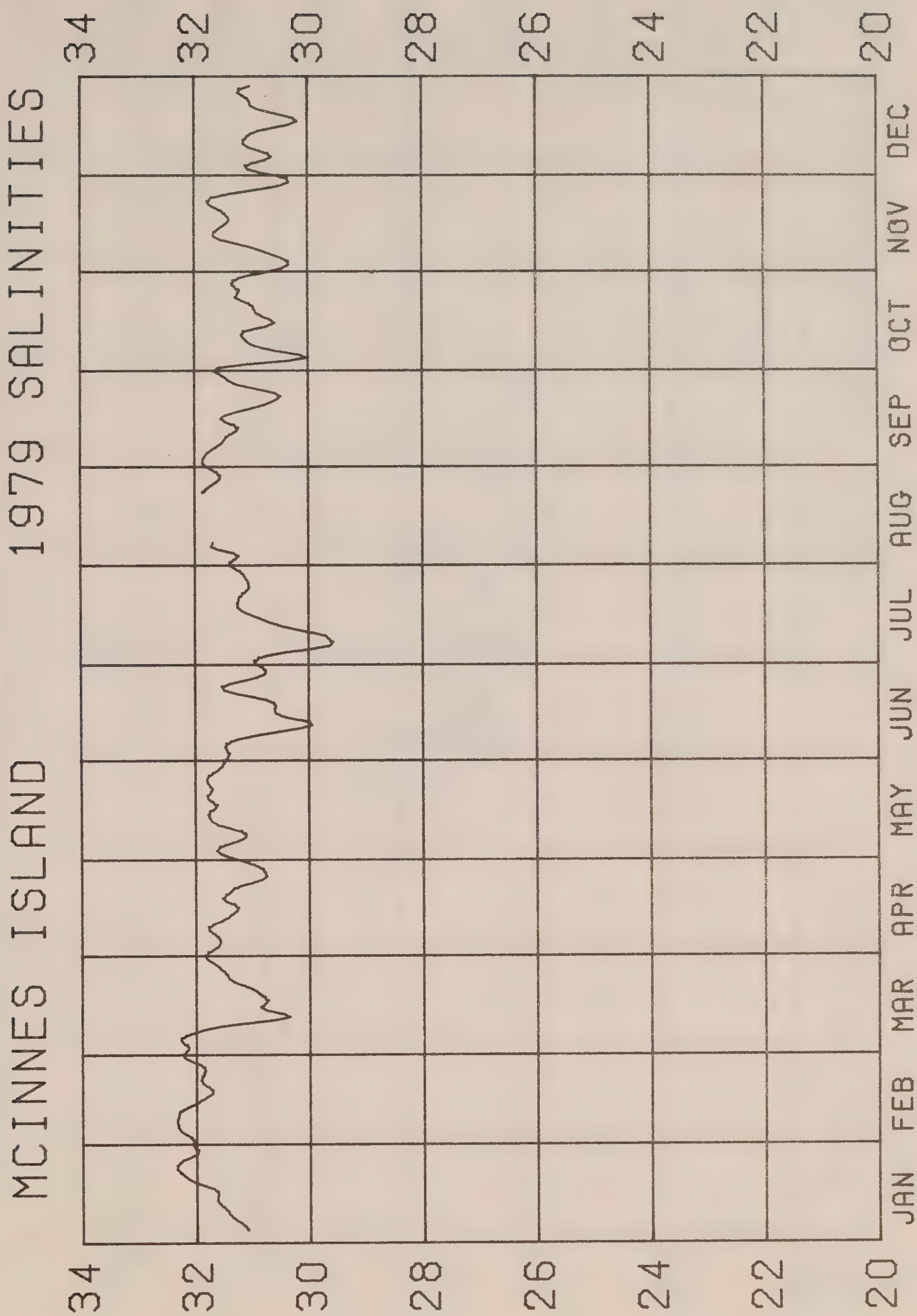
28
26
24
22
20
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC



CAPE ST JAMES
1979 TEMPERATURES
°C
22
18
14
10
6
2
-2
°F
70
65
60
55
50
45
40
35
30
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC


MCINNES ISLAND 1979 TEMPERATURES
°C
22
18
14
10
6
2
-2
°F
70
65
60
55
50
45
40
35
30
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


MCINNES ISLAND 1979 SALINITIES
34
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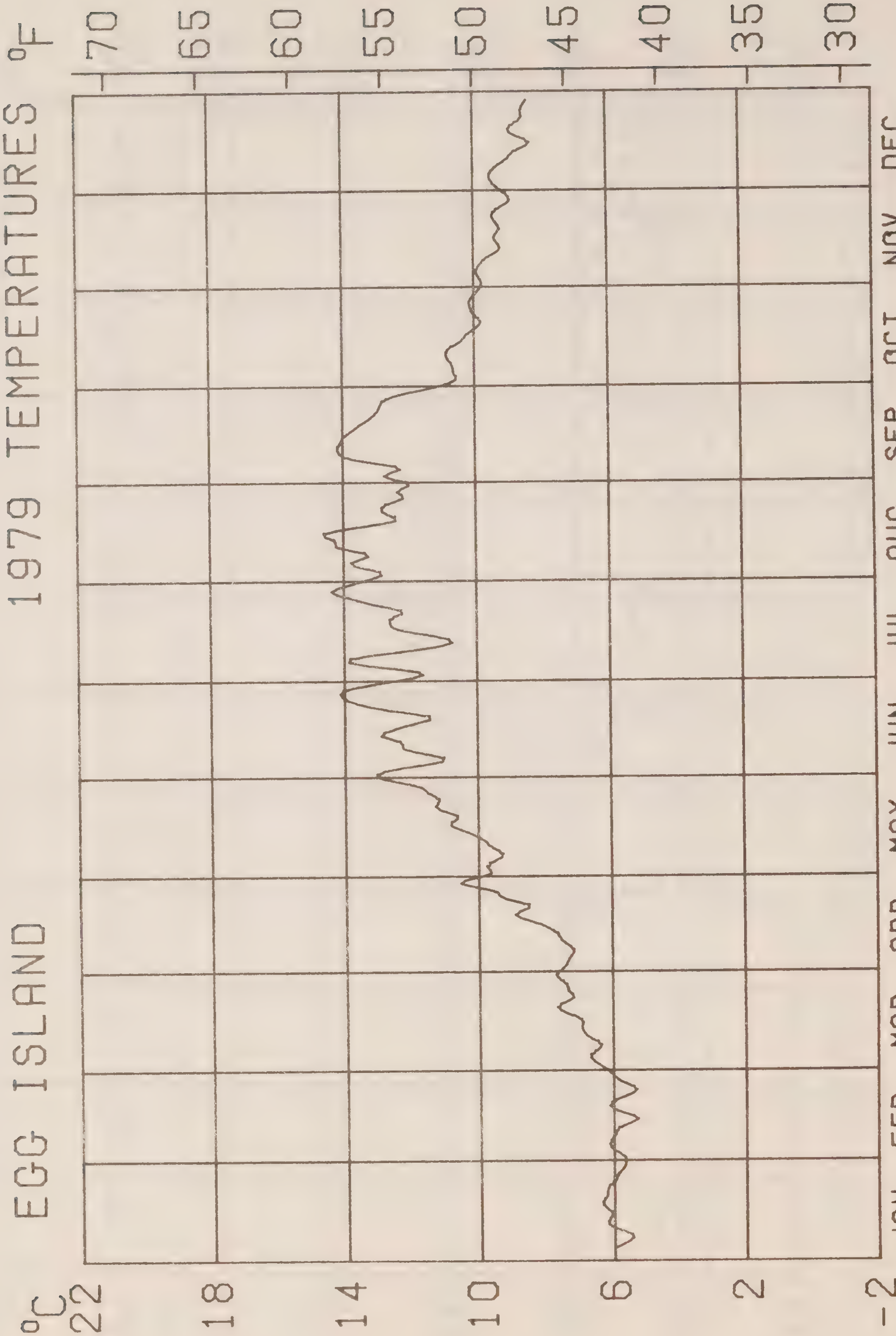
20
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


EGG ISLAND
1979 TEMPERATURES
°C
22
18
14
10
6
2
-2
°F
70
65
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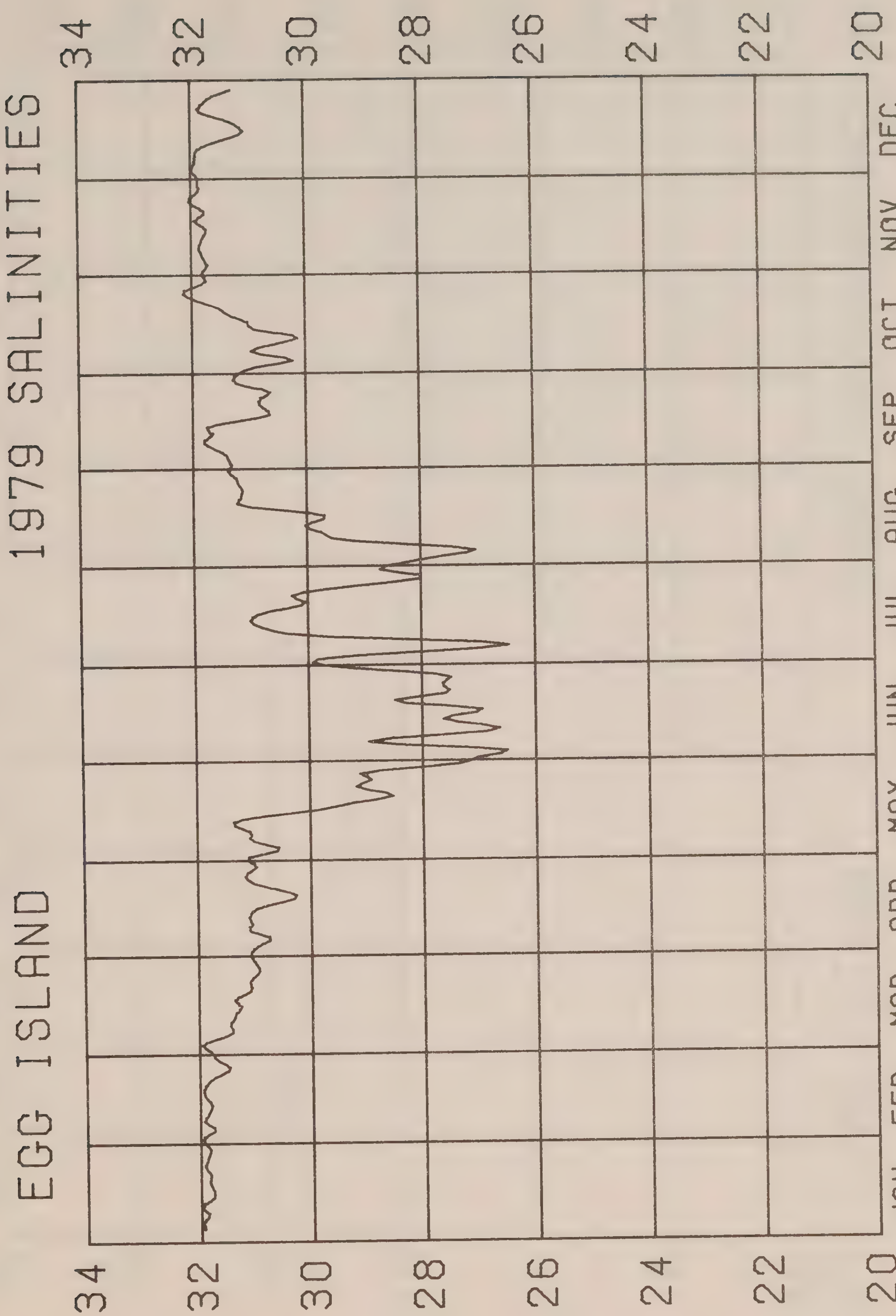
55
50
45
40
35
30
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


EGG ISLAND 1979 SALINITIES
34
32
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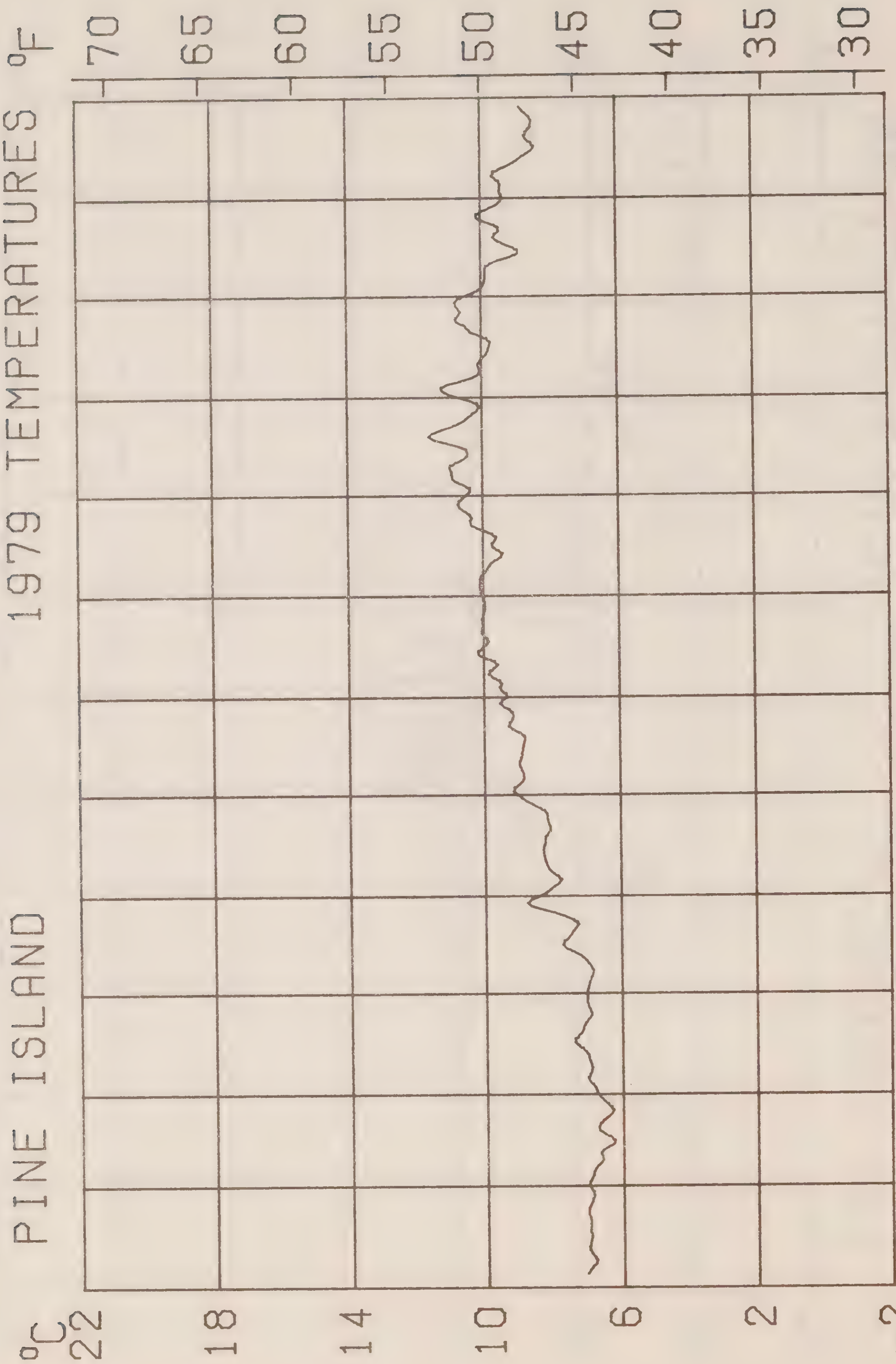
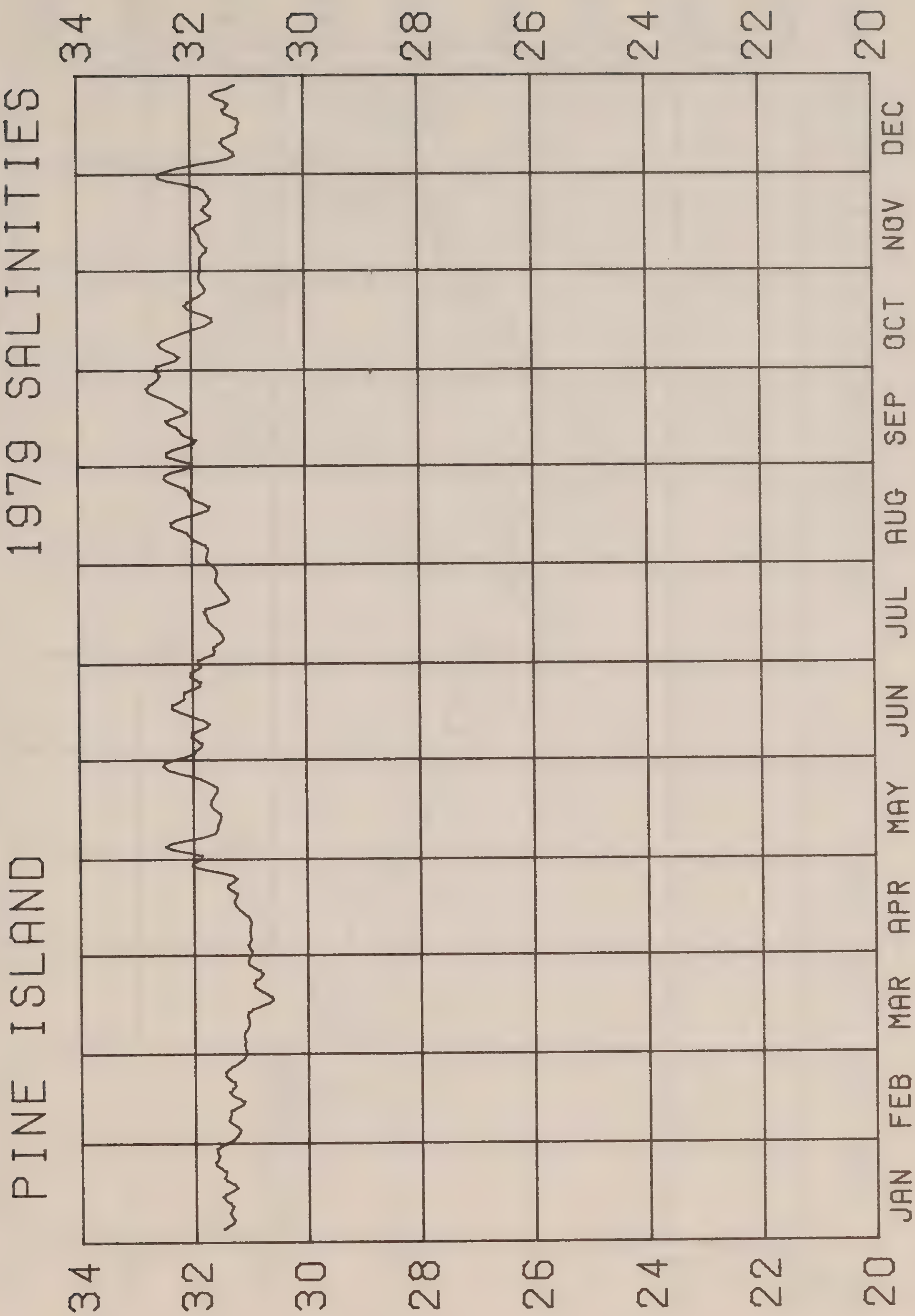
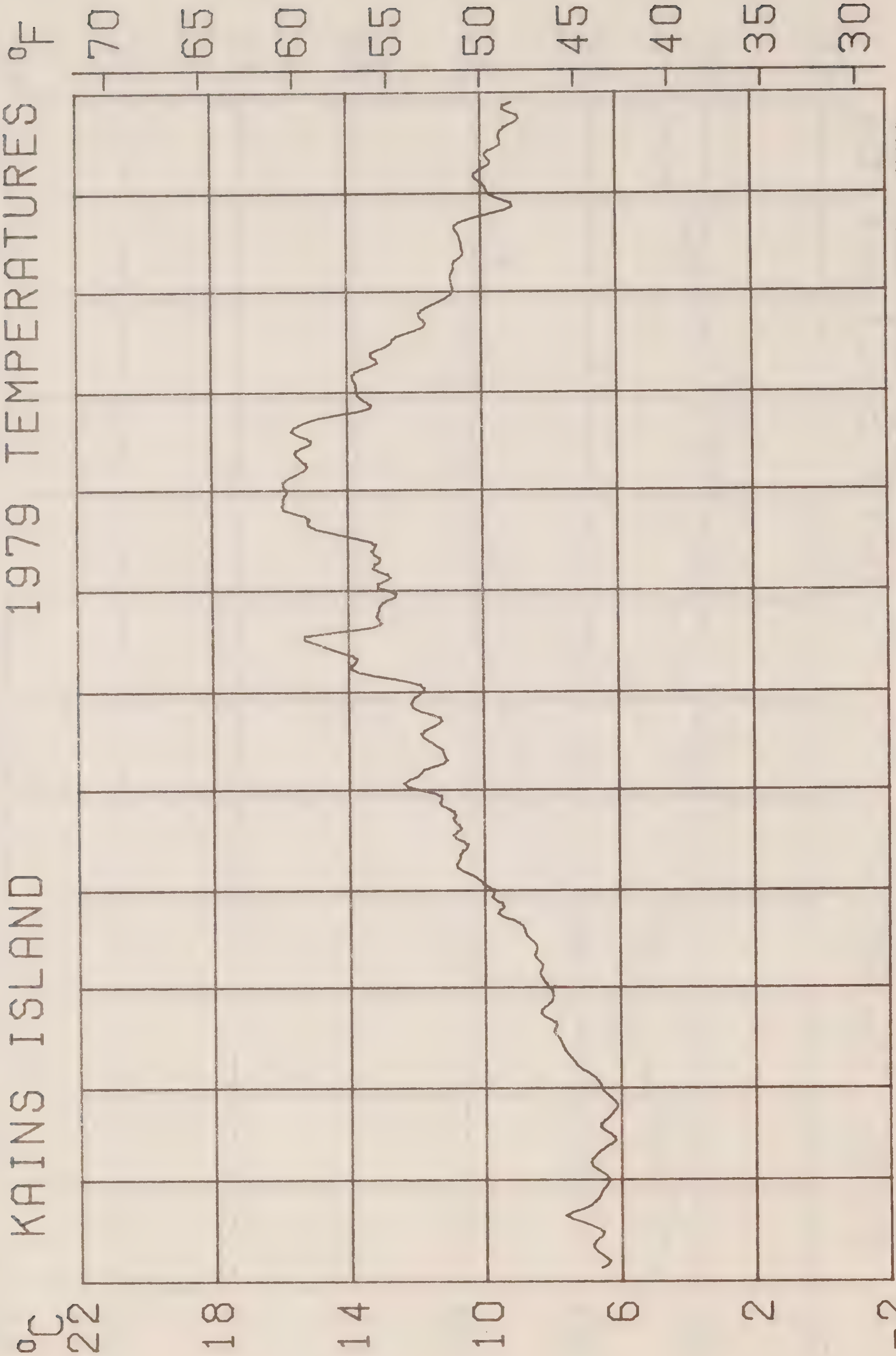
28
26
24
22
20
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


PINE ISLAND 1979 TEMPERATURES
°F
70
65
60
55
50
45
40
35
30
°C
22
18
14
10
6
2
-2
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


PINE ISLAND 1979 SALINITIES
34
32
30
28
26
24
22
20
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


KAINS ISLAND 1979 TEMPERATURES
°C
22
18
14
10
6
2
-2
°F
70
65
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55
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35
30
JAN
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MAY
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SEP
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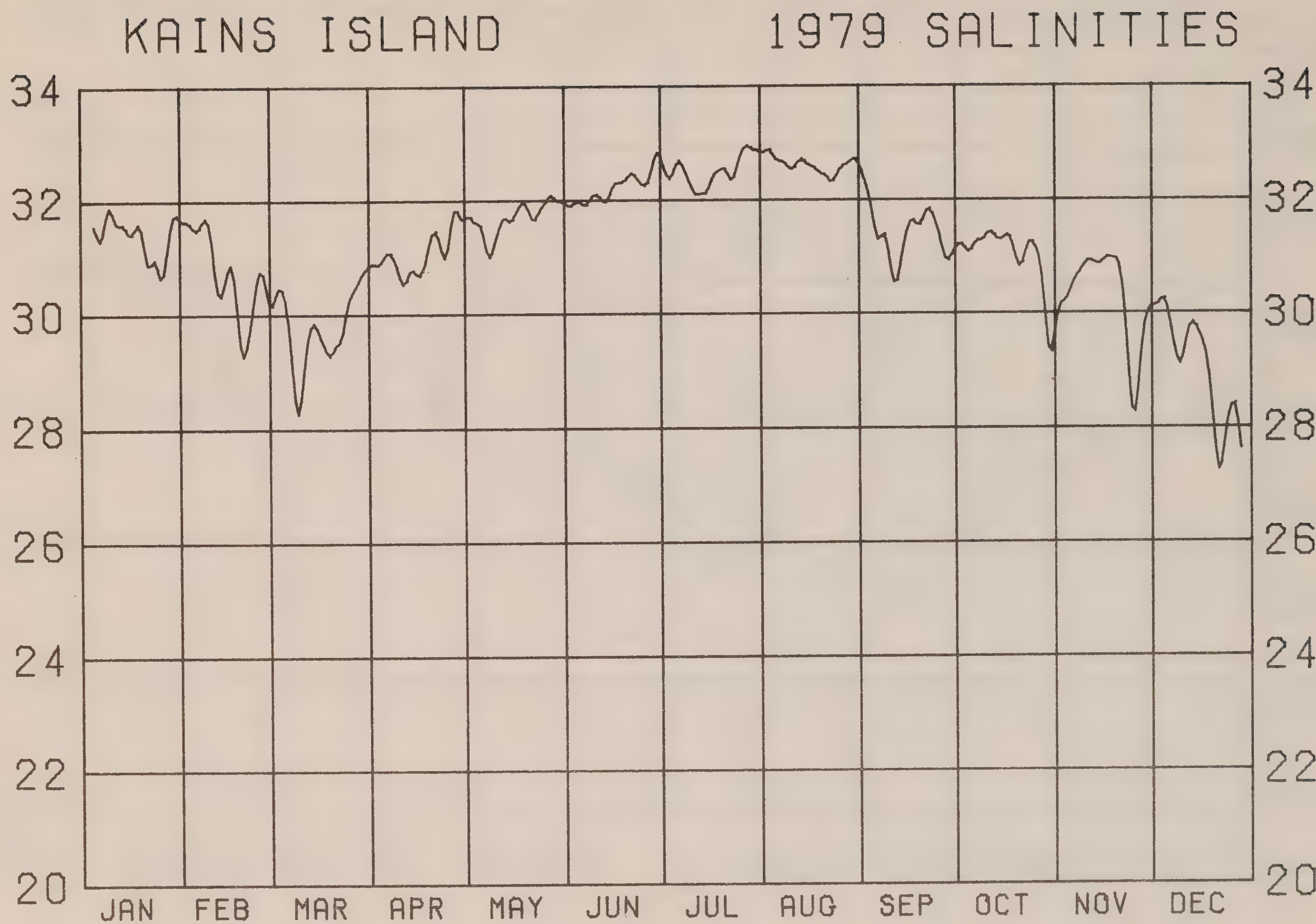
DEC


KAINS ISLAND
1979 SALINITIES
34
32
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JAN
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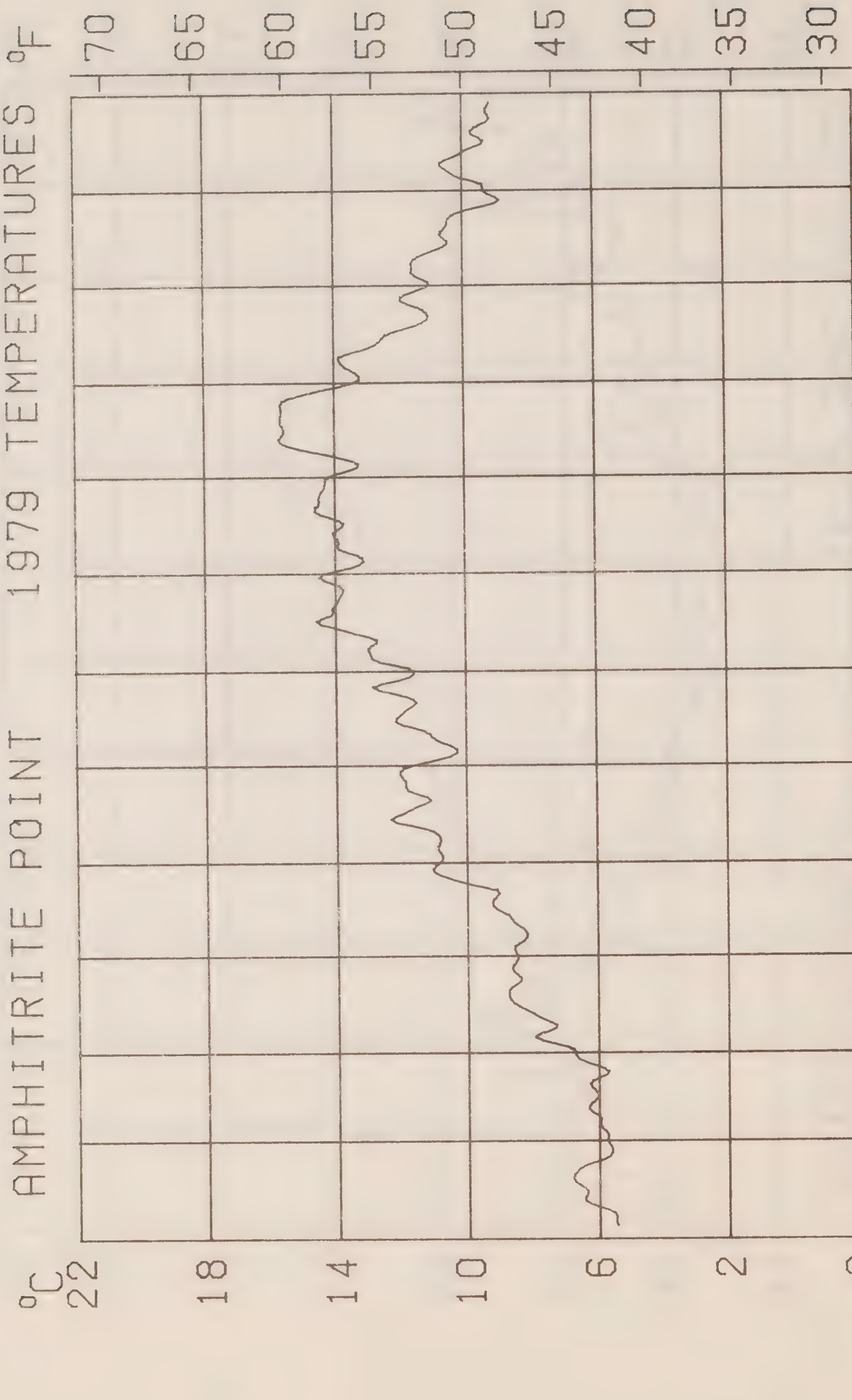
NOV
DEC


AMPHITRITE POINT 1979 TEMPERATURES
°C
22
18
14
10
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°F
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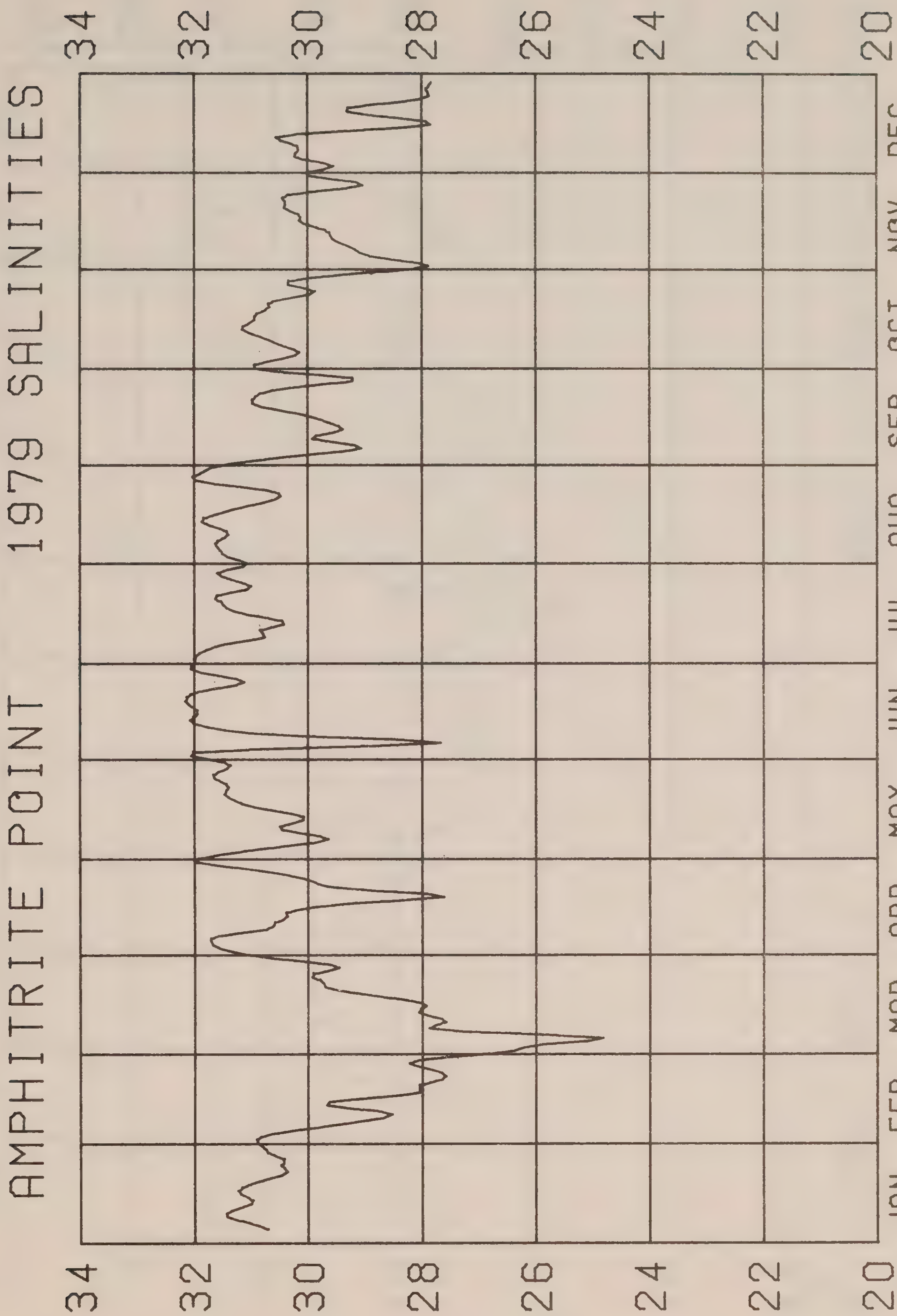
30
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


AMPHITRITE POINT 1979 SALINITIES
34
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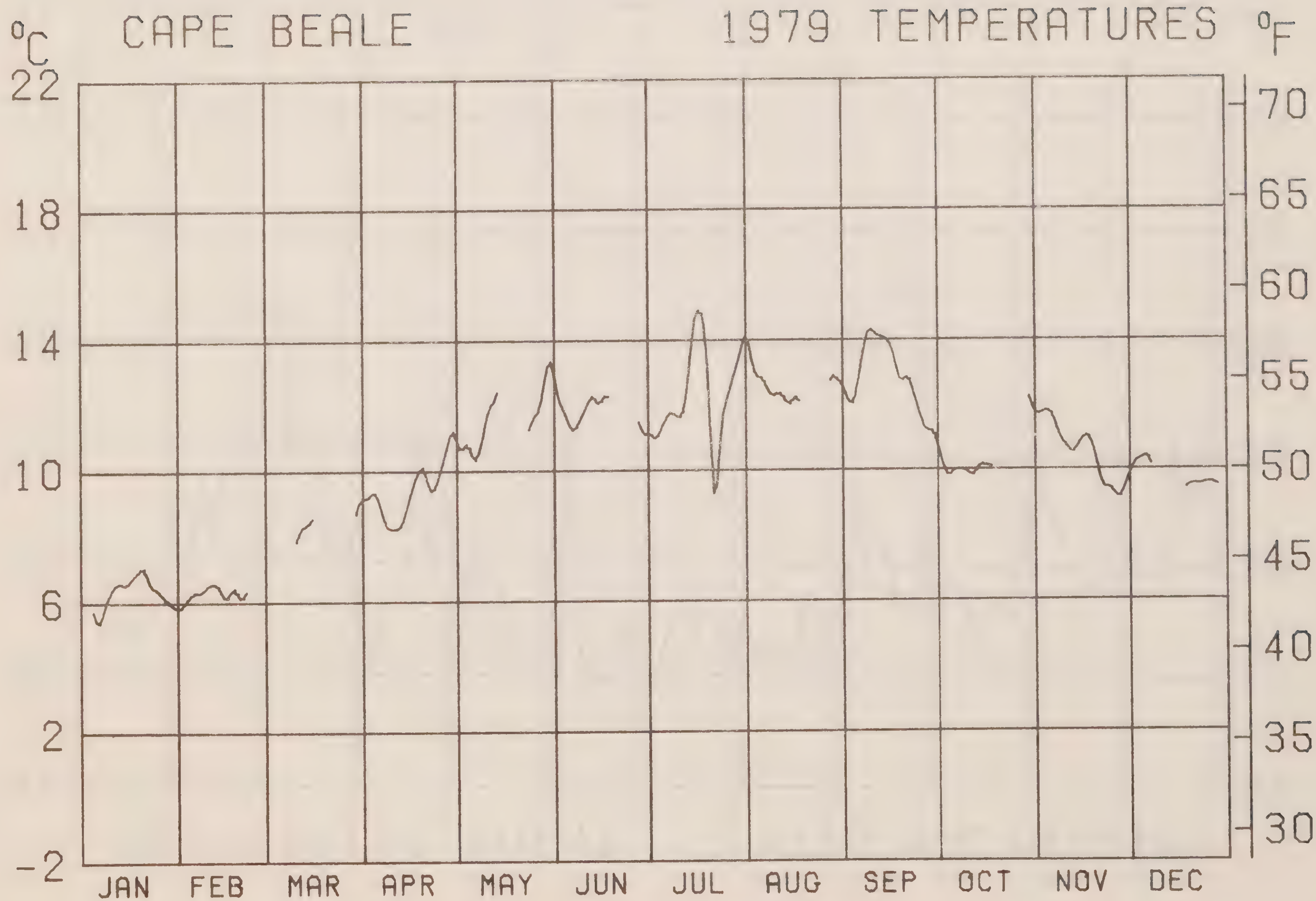
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


°C
CAPE BEALE
1979 TEMPERATURES
°F
22
18
14
10
6
2
-2
70
65
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JAN
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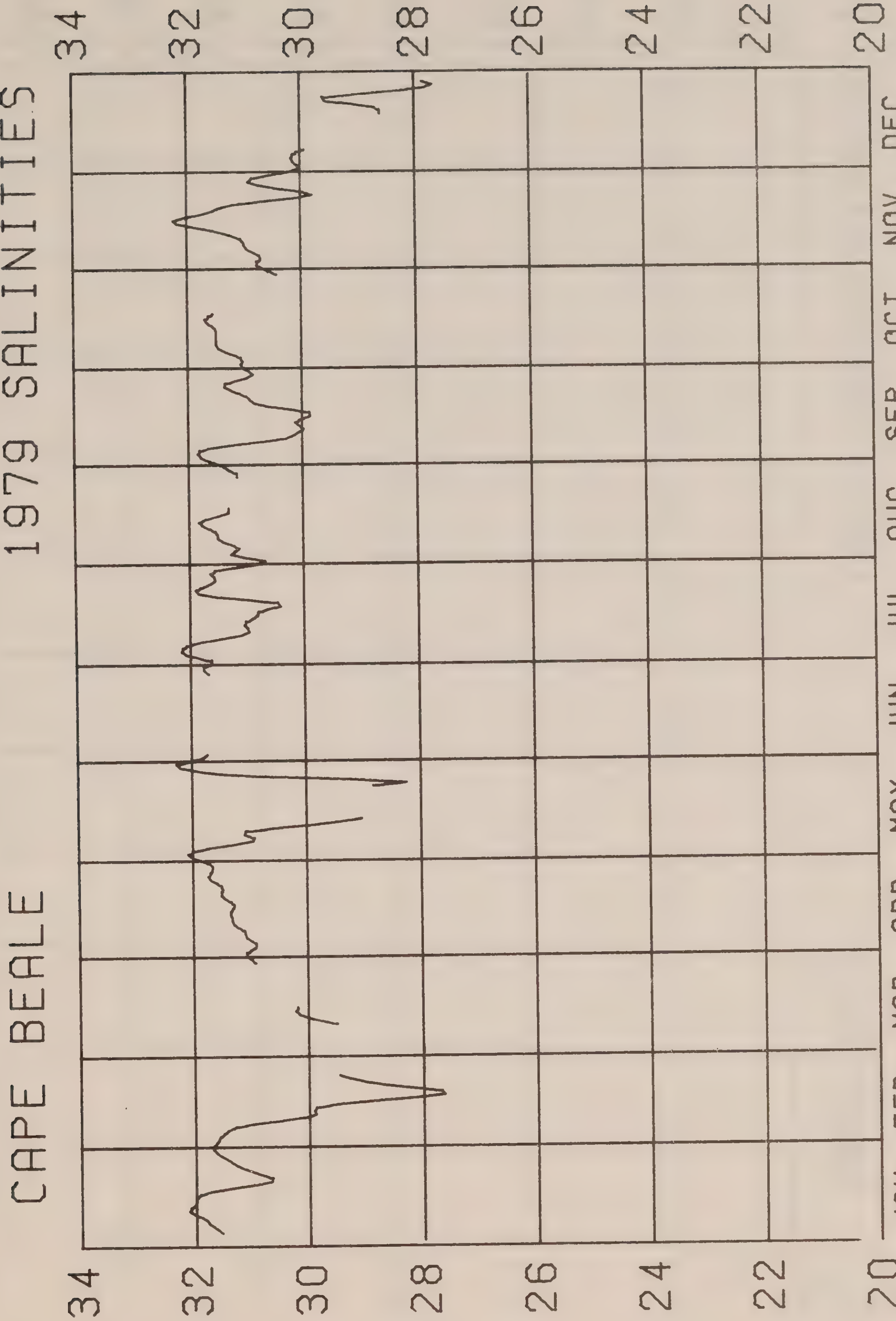
DEC


CAPE BEALE 1979 SALINITIES
34
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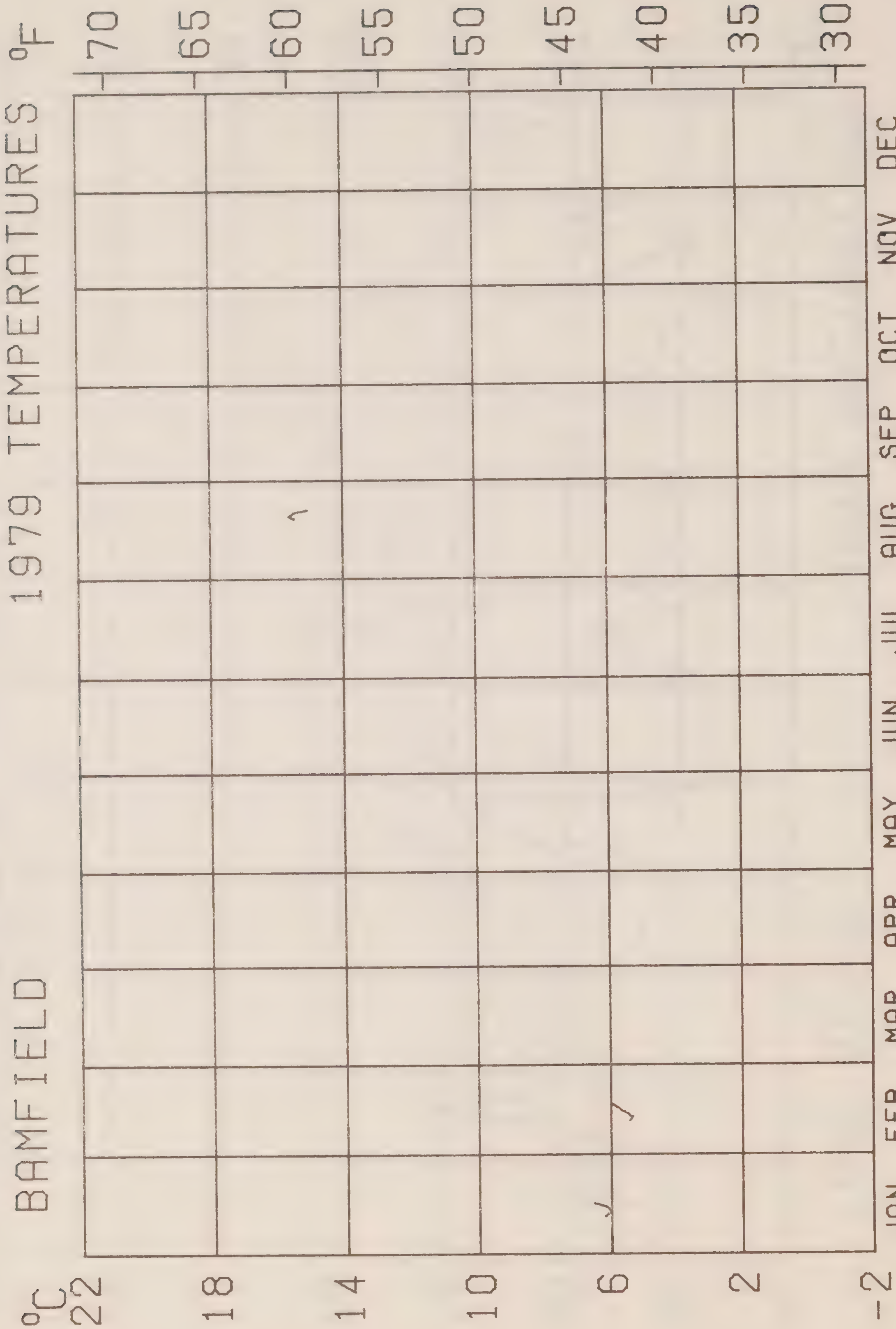
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


BAMFIELD 1979 TEMPERATURES
°C
22
18
14
10
6
2
-2
°F
70
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JAN
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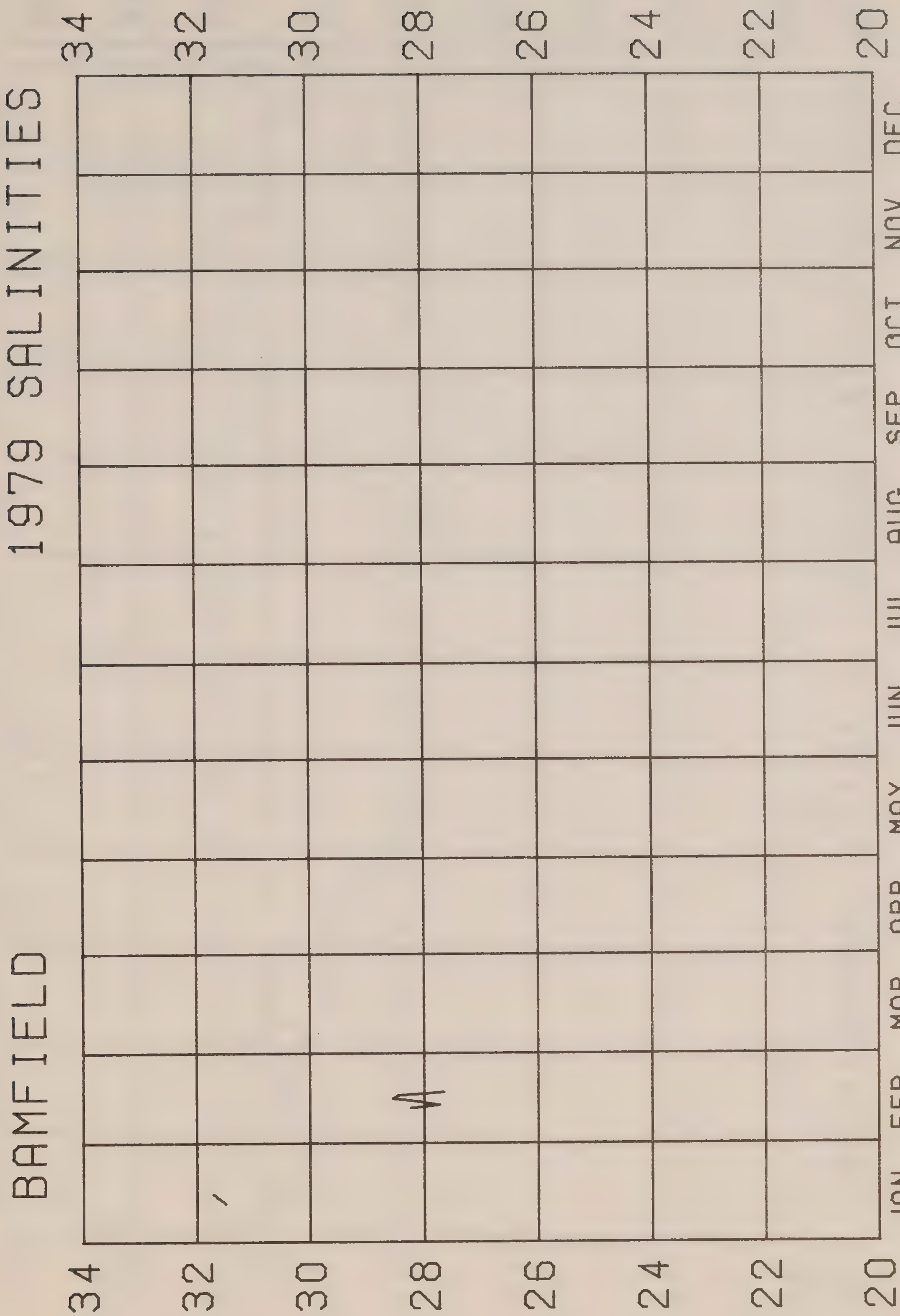
OCT
NOV
DEC


BAMFIELD 1979 SALINITIES
34
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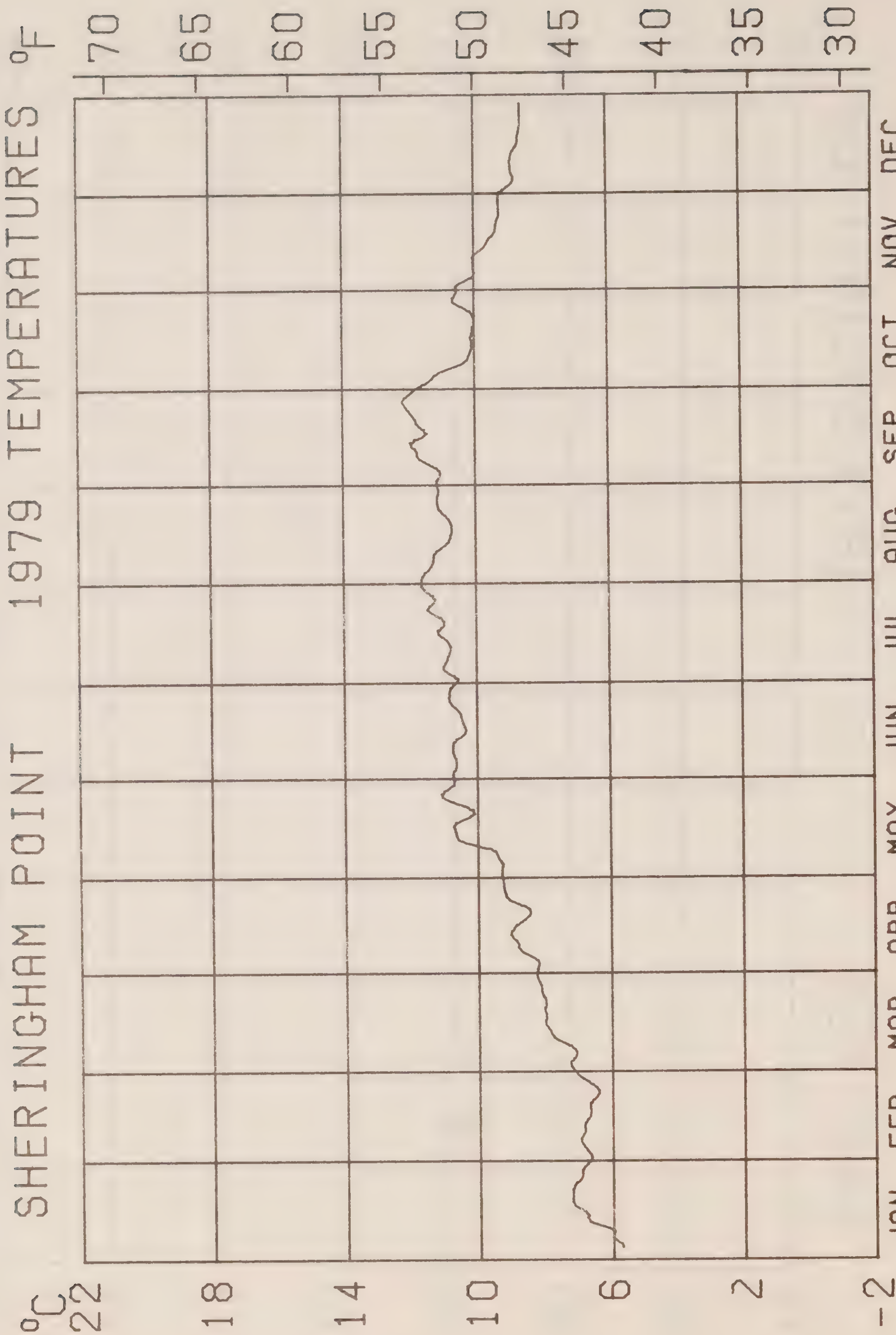
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


SHERINGHAM POINT 1979 TEMPERATURES
°F
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40
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30
°C
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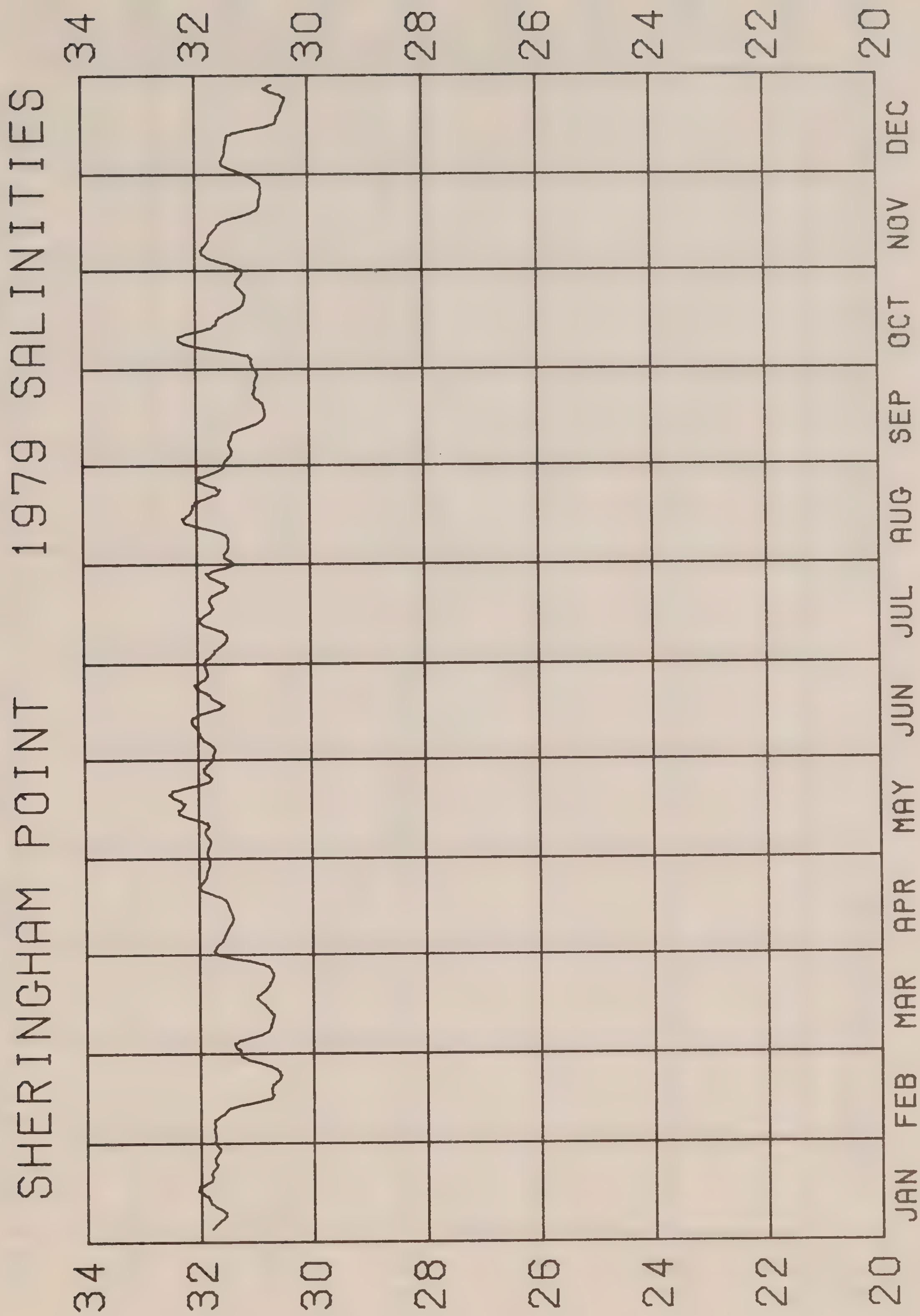
SHERINGHAM POINT 1979 SALINITIES
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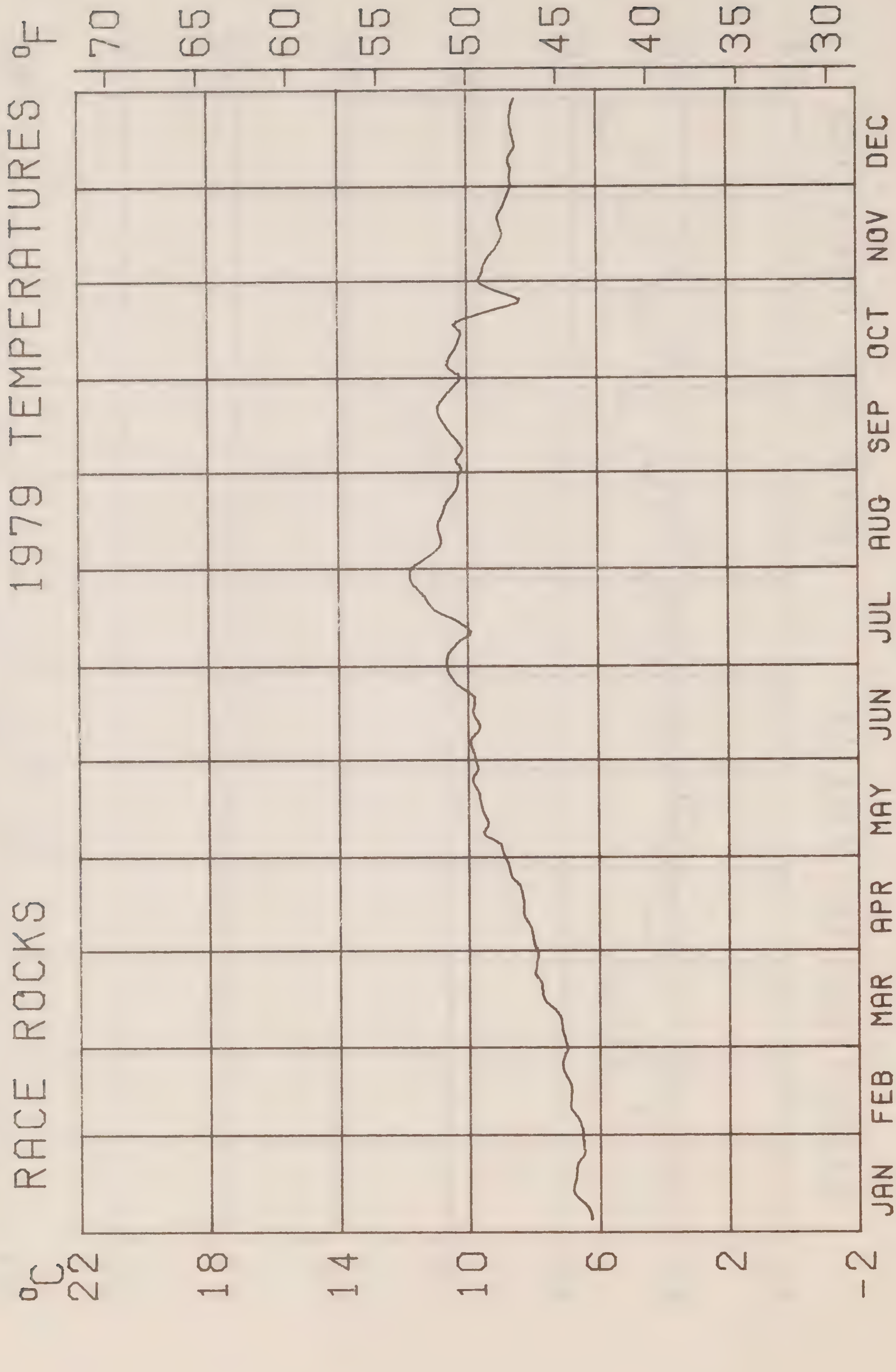
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


RACE ROCKS 1979 TEMPERATURES
°F
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55
50
45
40
35
30
°C
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-2
JAN
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JUL
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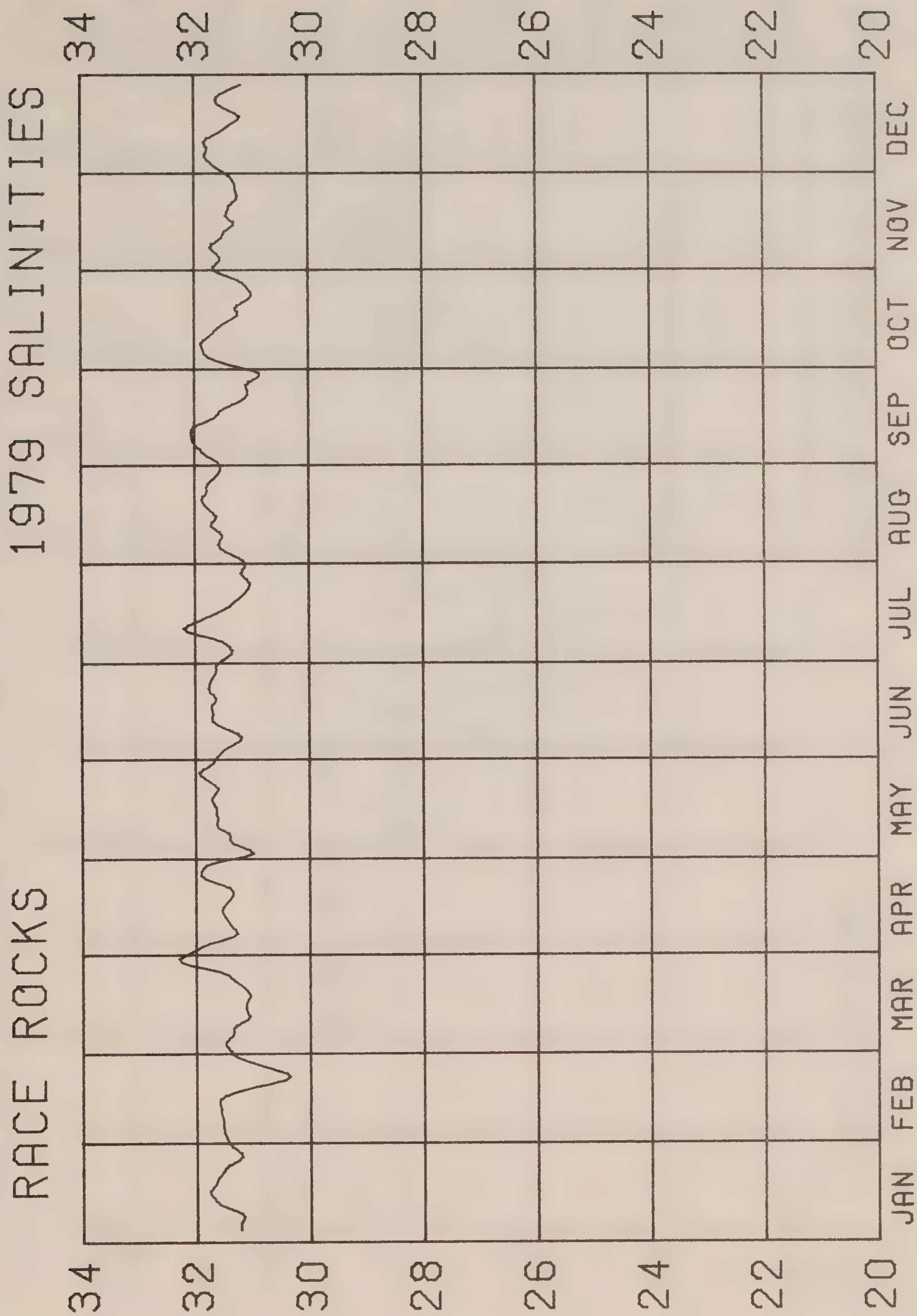
SEP
OCT
NOV
DEC


RACE ROCKS 1979 SALINITIES
34
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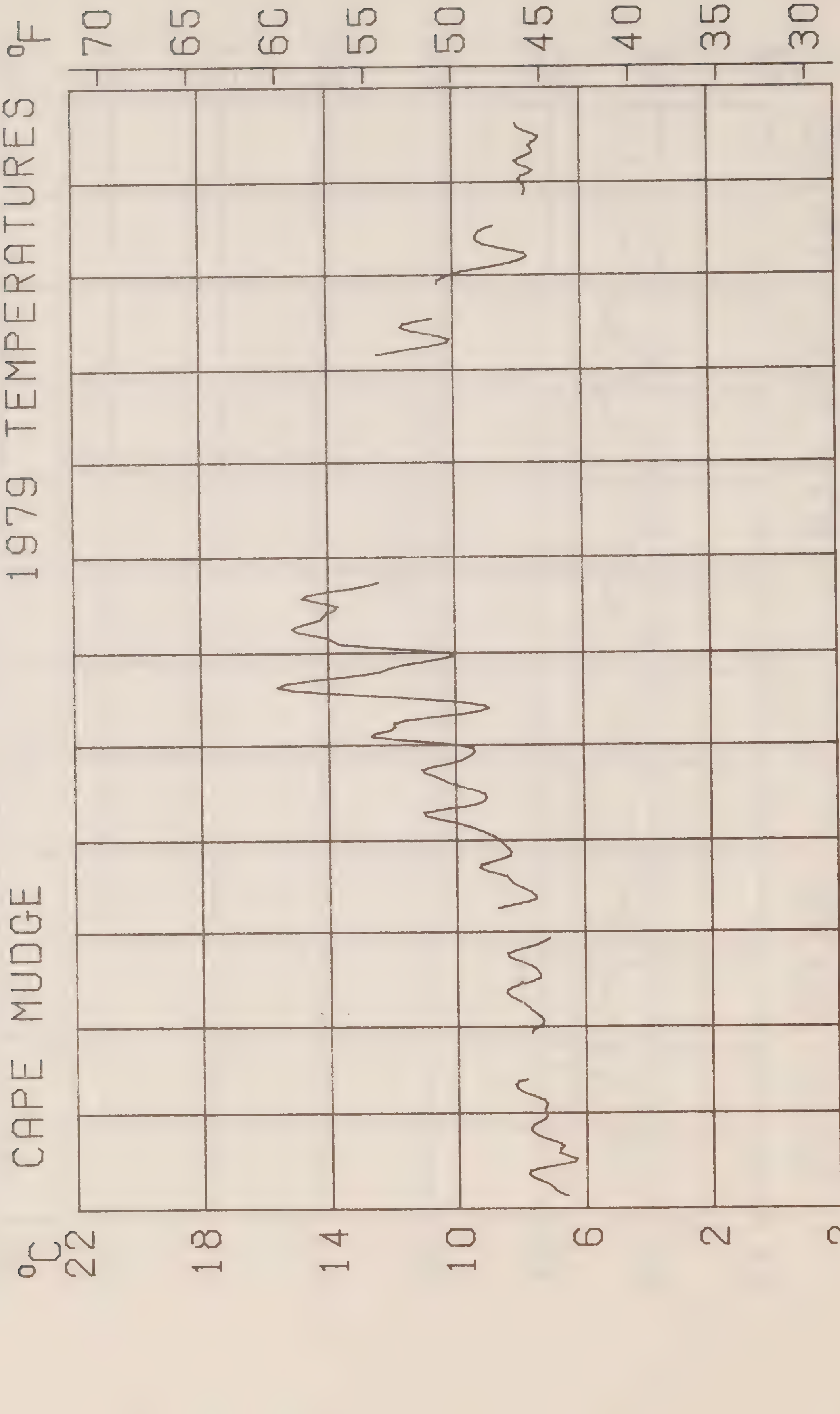
28
26
24
22
20
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


CAPE MUDGE 1979 TEMPERATURES
°C
°F
22
18
14
10
6
2
−2
70
65
60
55
50
45
40
35
30
JAN
FEB
MAR
APR
MAY
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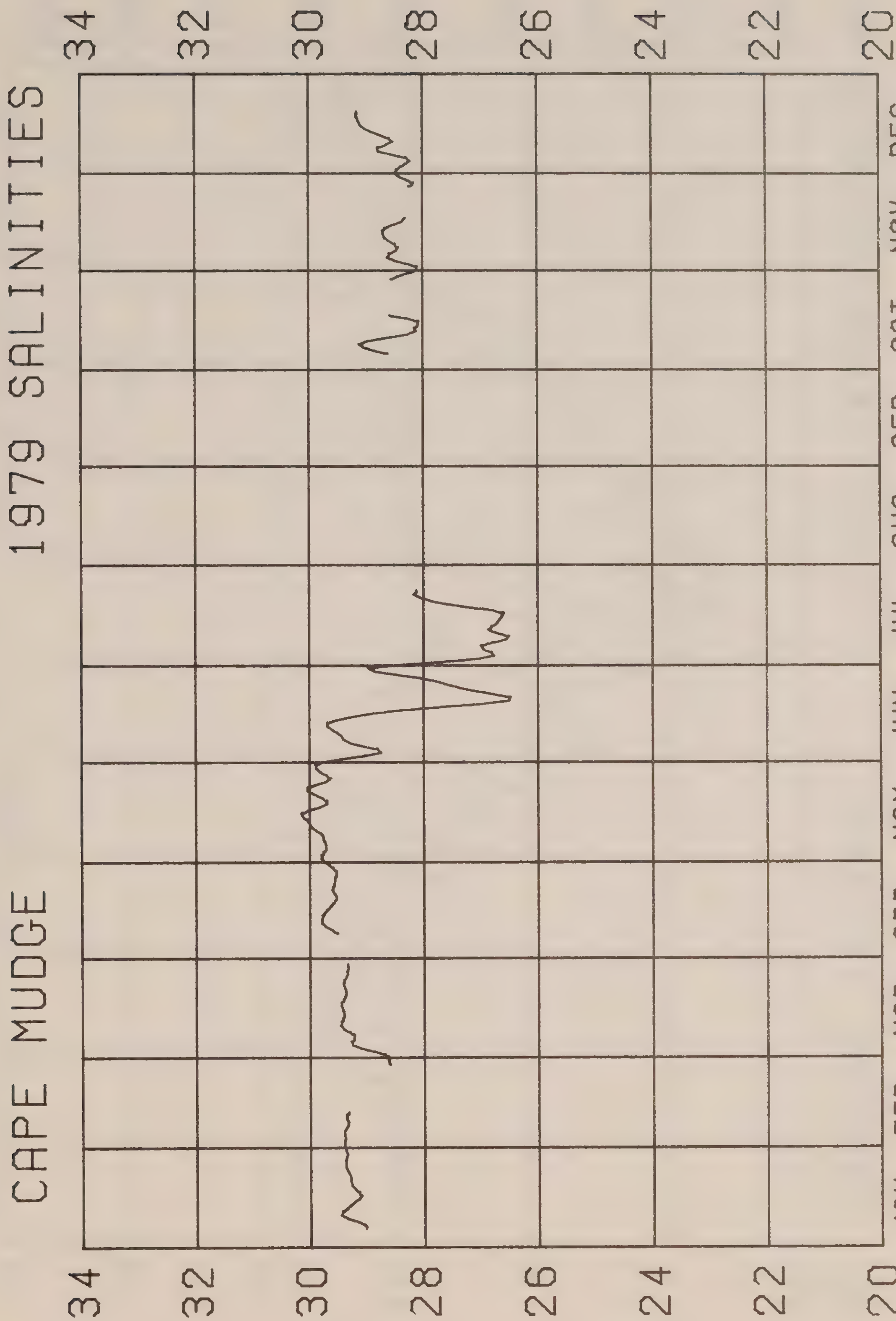
SEP
OCT
NOV
DEC


CAPE MUDGE 1979 SALINITIES
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32
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28
26
24
22
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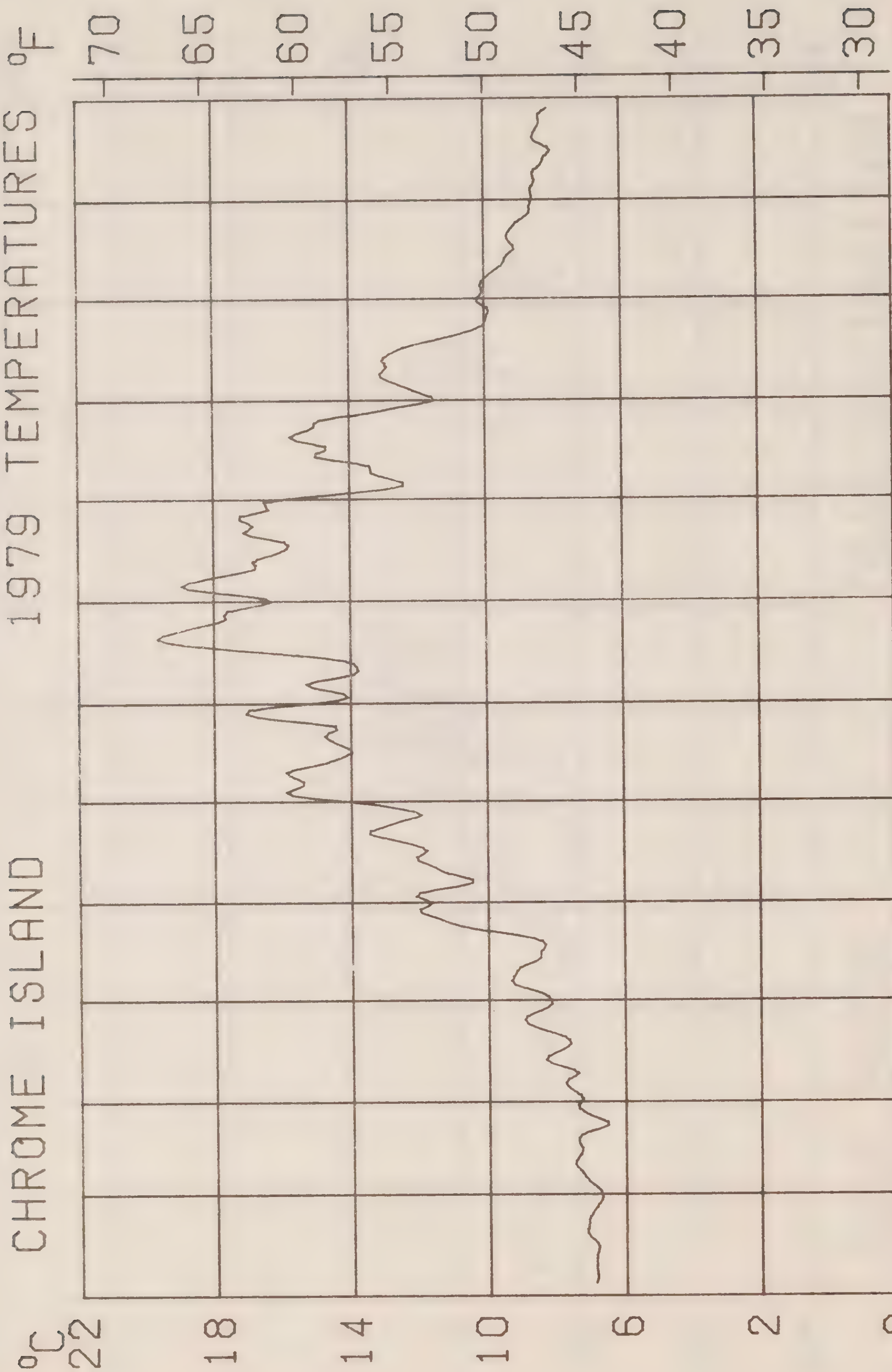
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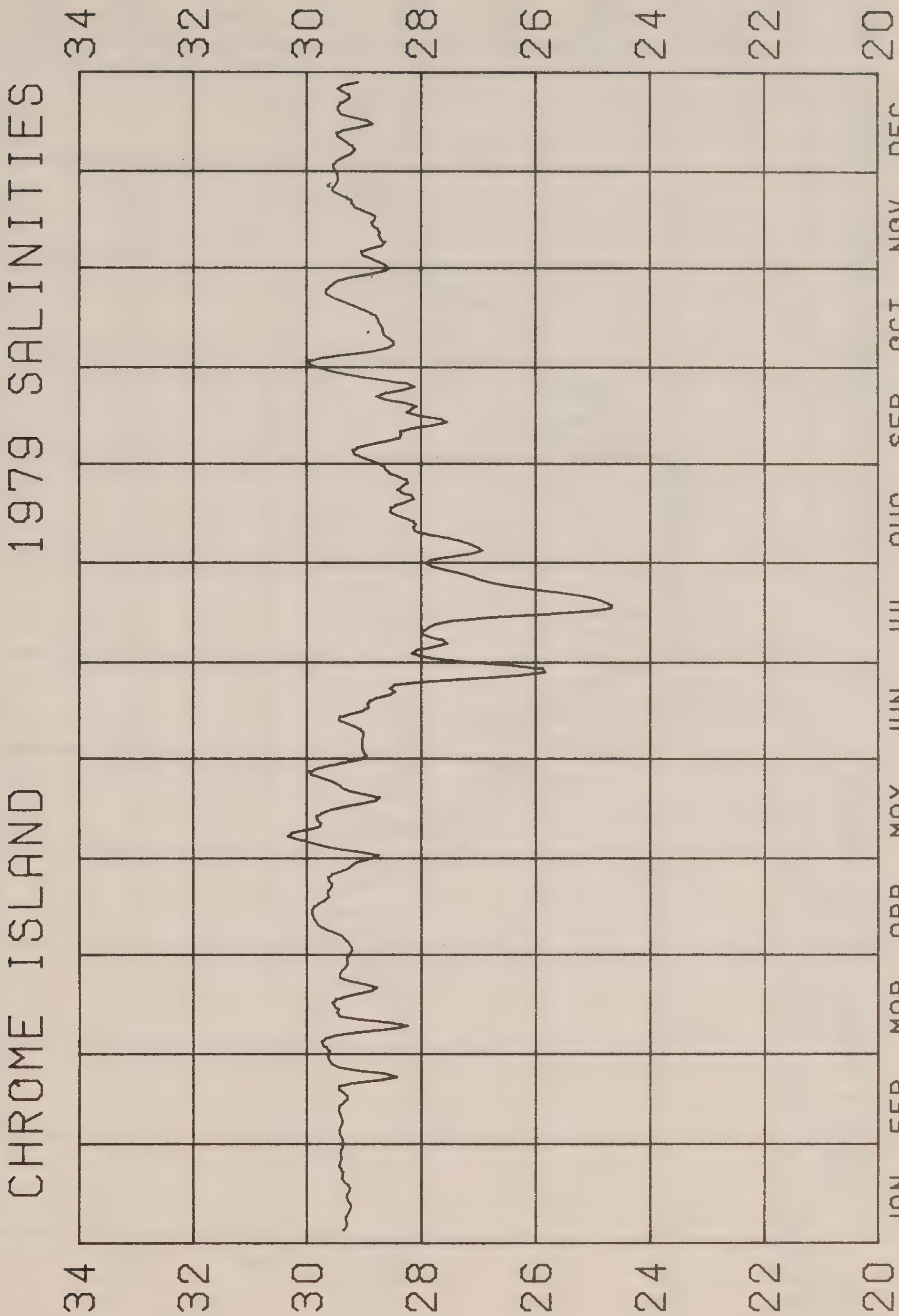
°F
70
65
60
55
50
45
40
35
30
°C
22
18
14
10
6
2
-2
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC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34
32
30
28
26
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22
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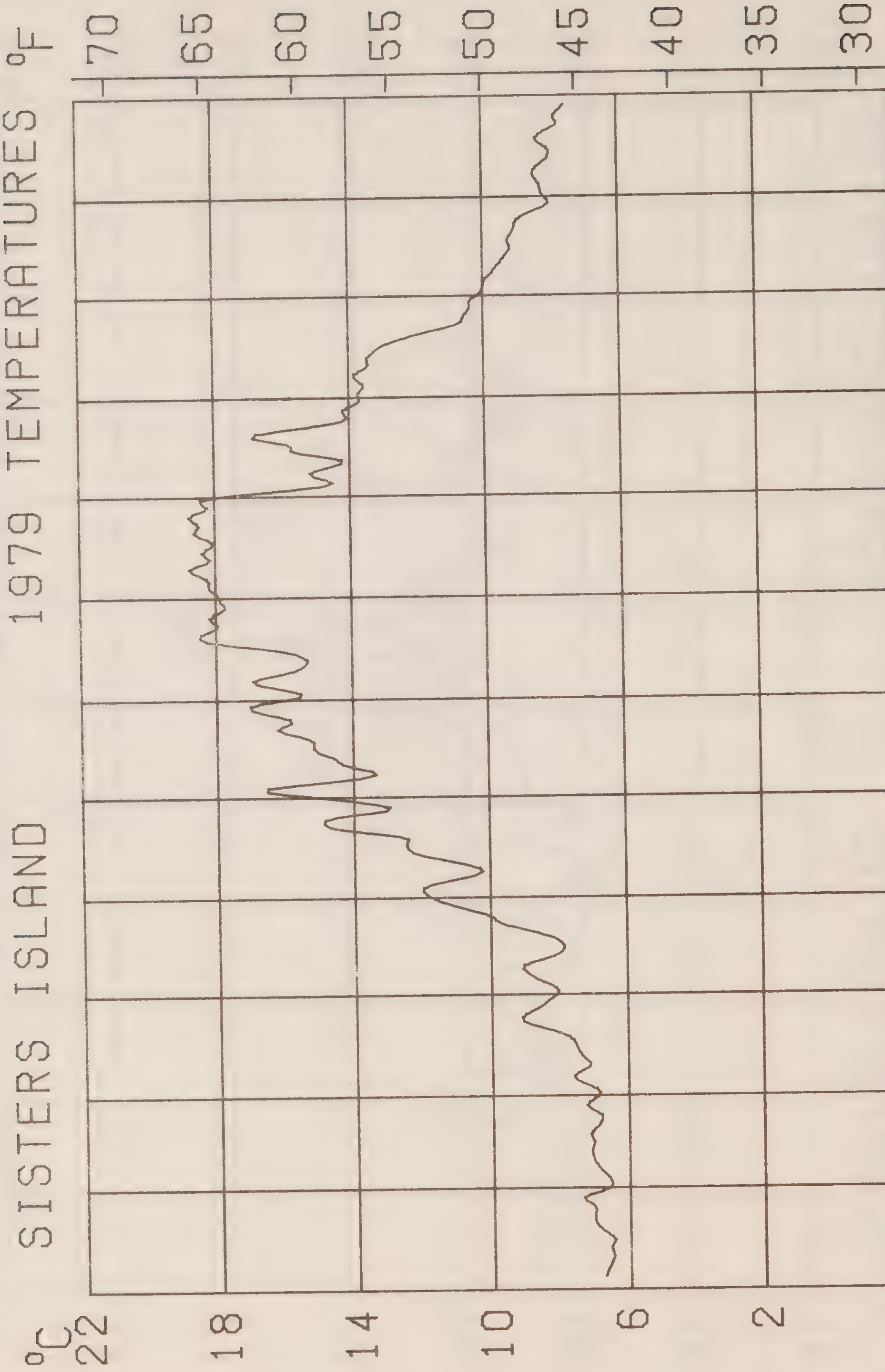

SISTERS ISLAND 1979 TEMPERATURES
°F
70
65
60
55
50
45
40
35
30
°C
22
18
14
10
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2
-2
JAN
FEB
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APR
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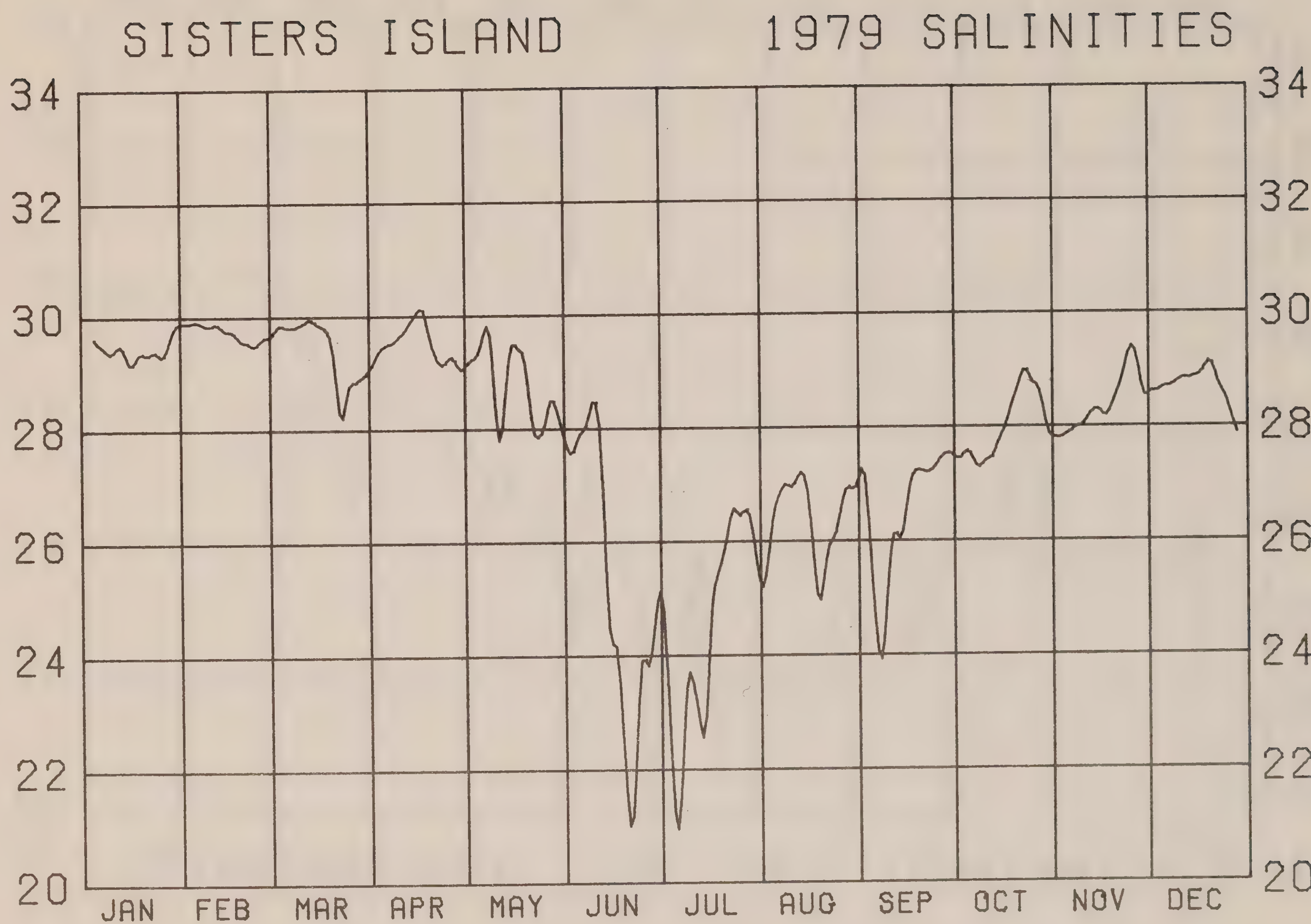
OCT
NOV
DEC


SISTERS ISLAND 1979 SALINITIES
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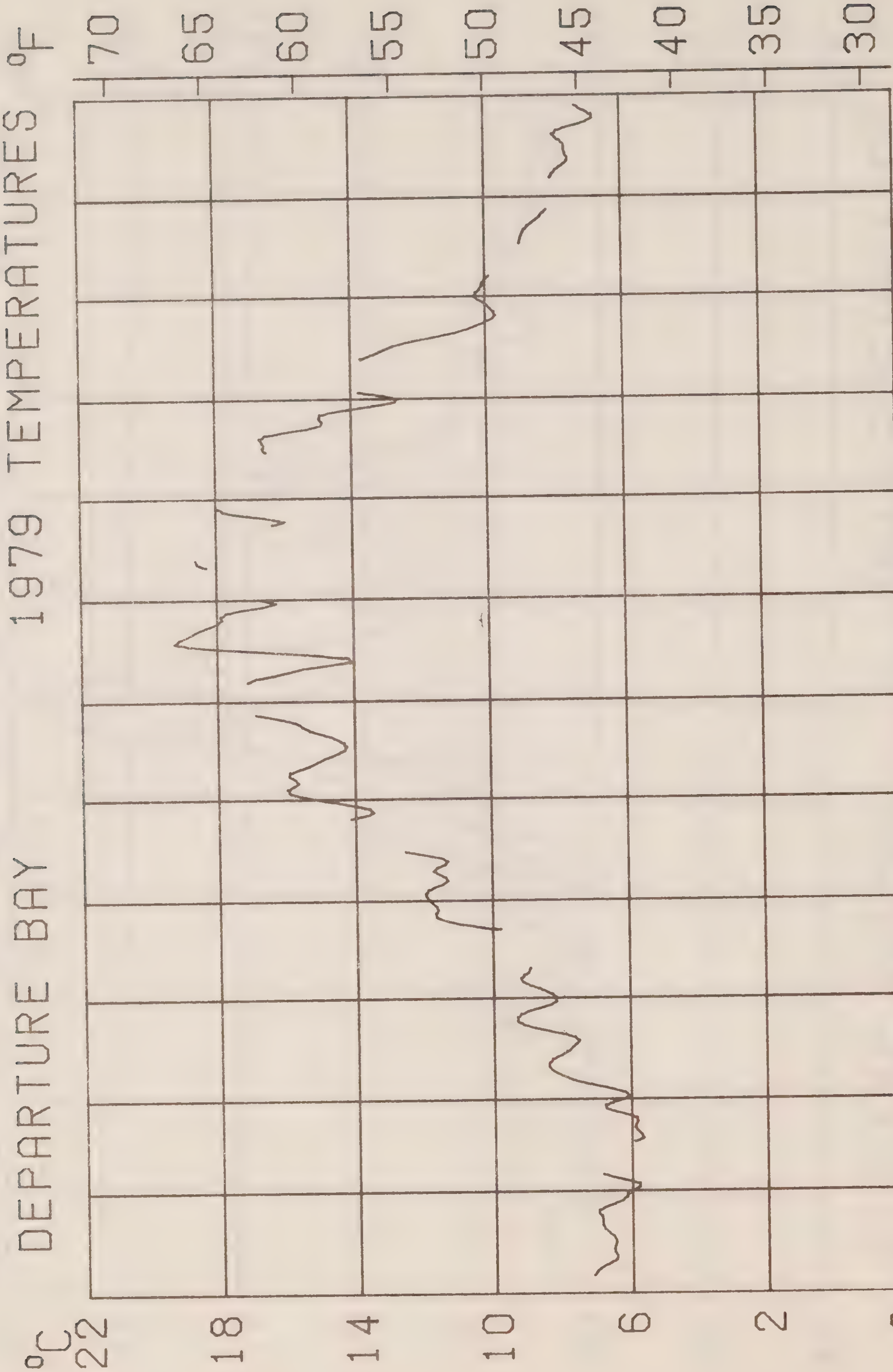
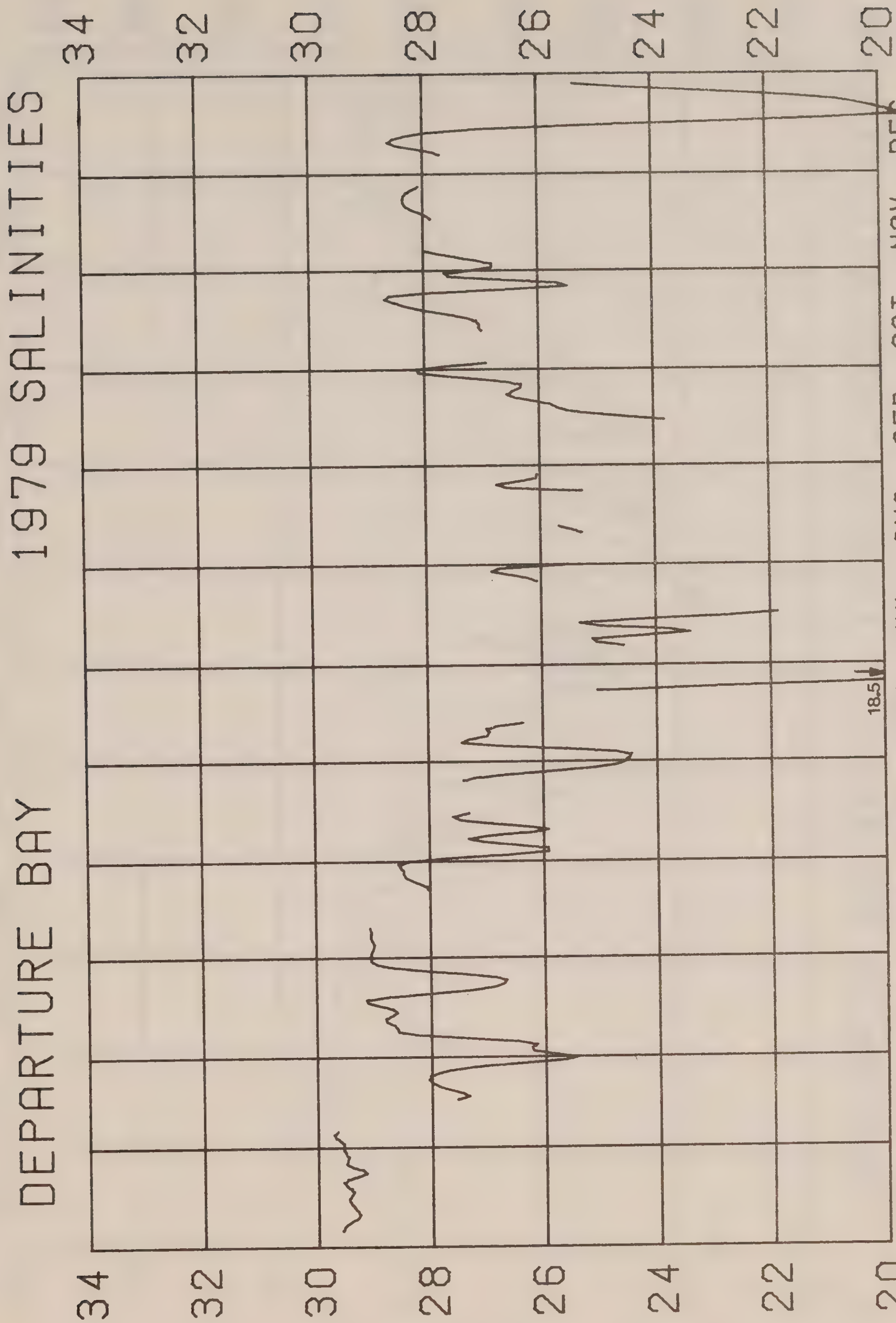
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


DEPARTURE BAY 1979 TEMPERATURES
°F
70
65
60
55
50
45
40
35
30
°C
22
18
14
10
6
2
-2
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC


DEPARTURE BAY 1979 SALINITIES
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32
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28
26
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22
20
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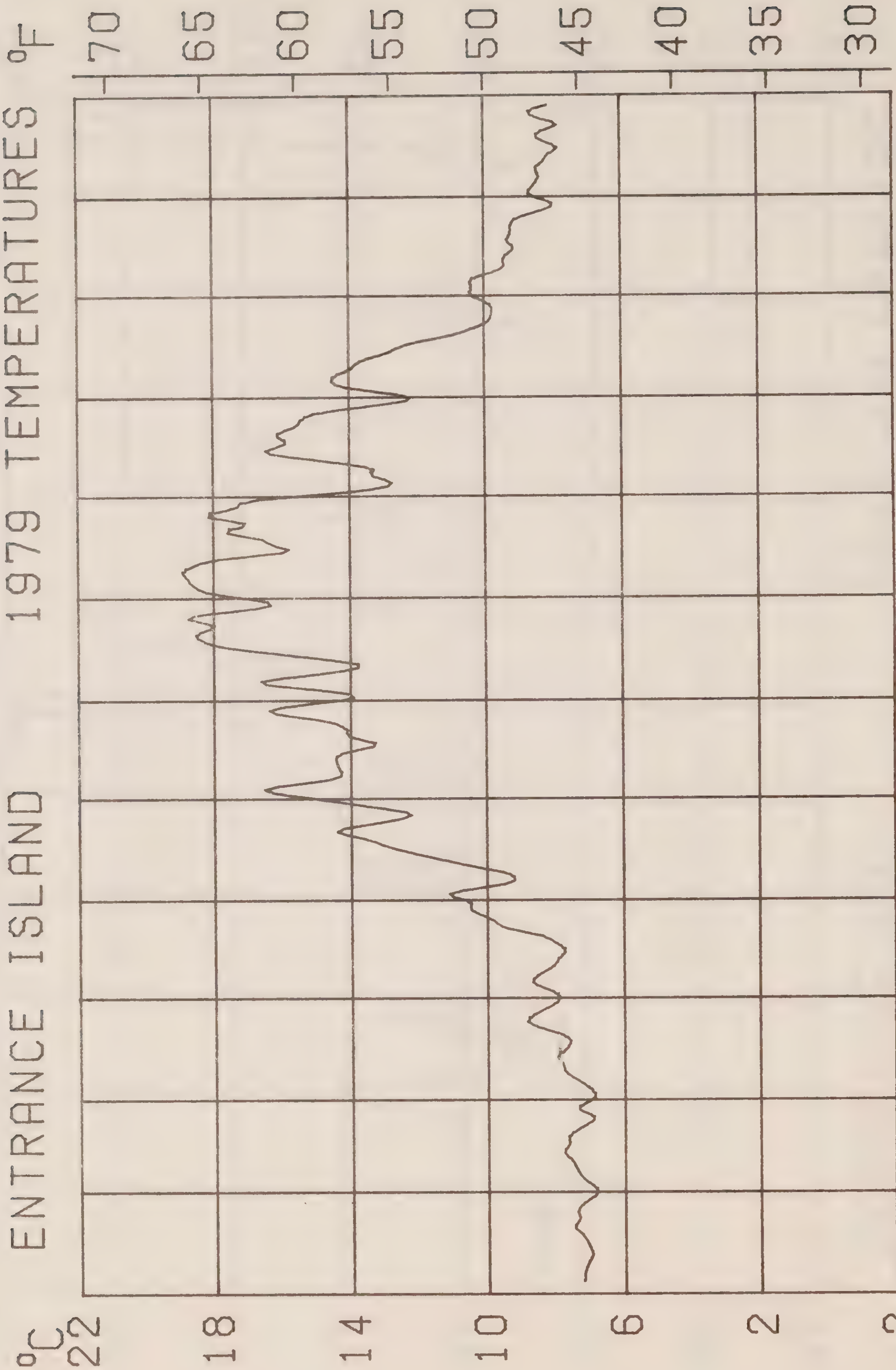
18.5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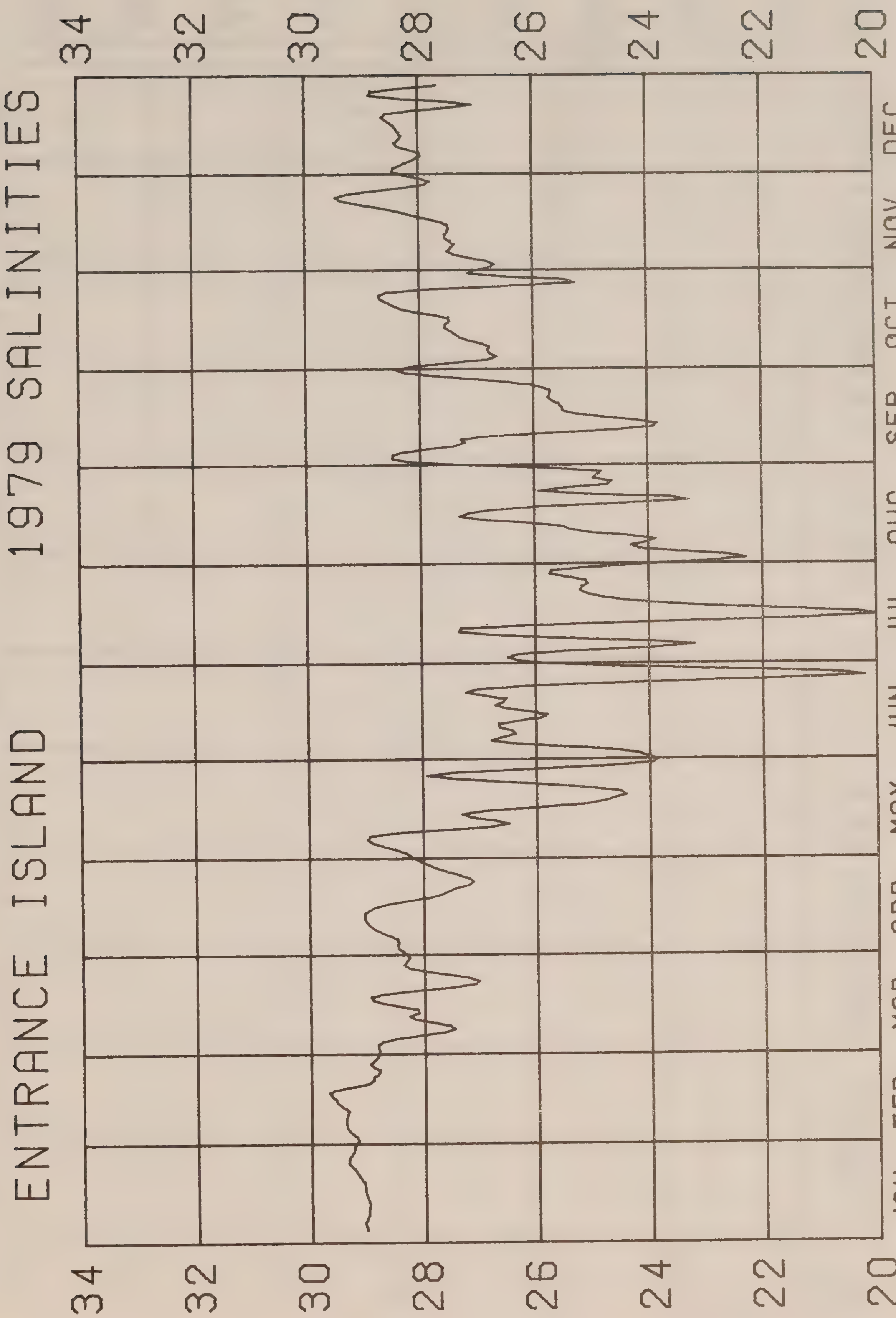
°F
70
65
60
55
50
45
40
35
30
°C
22
18
14
10
6
2
-2
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


ENTRANCE ISLAND 1979 SALINITIES
34
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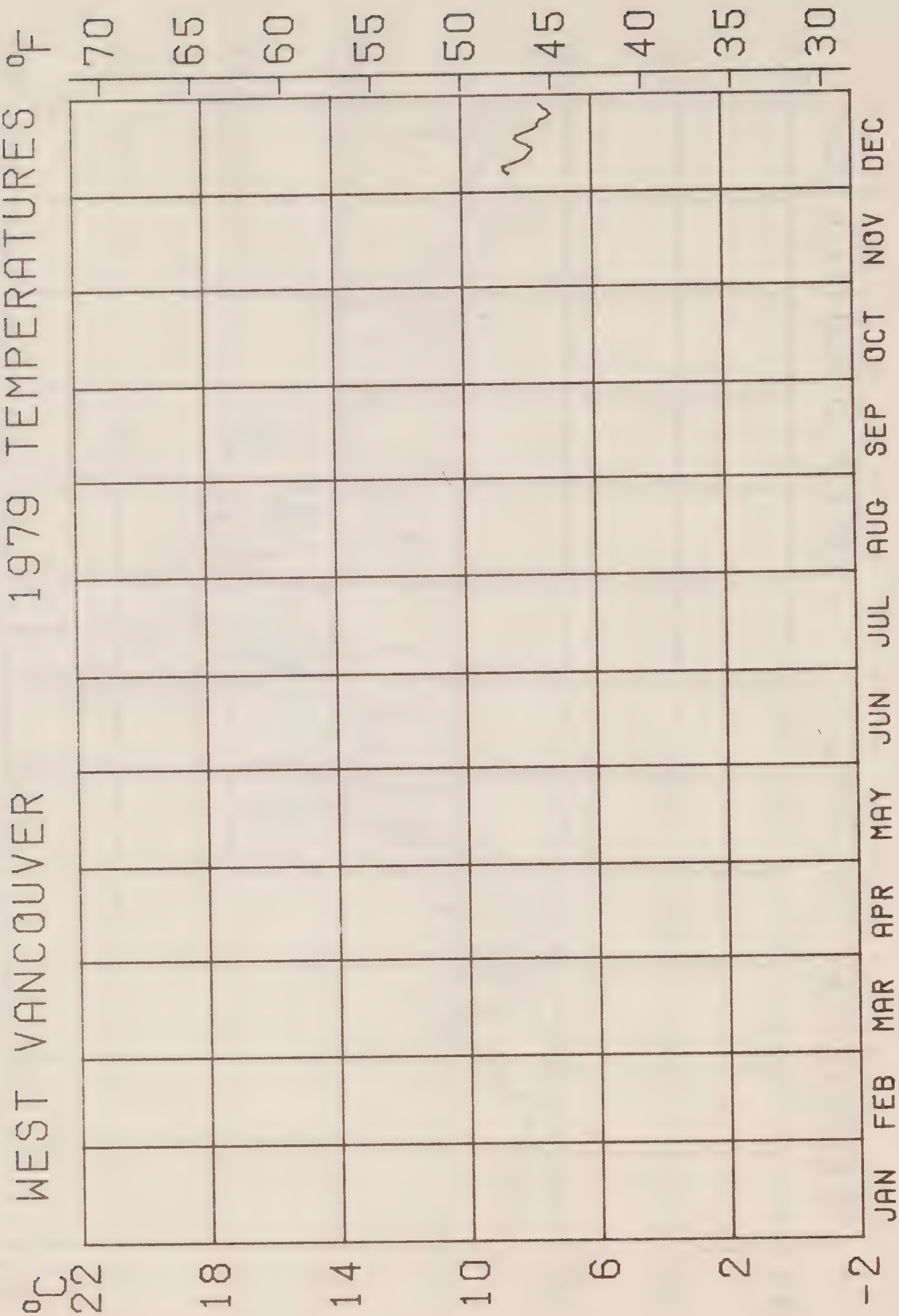
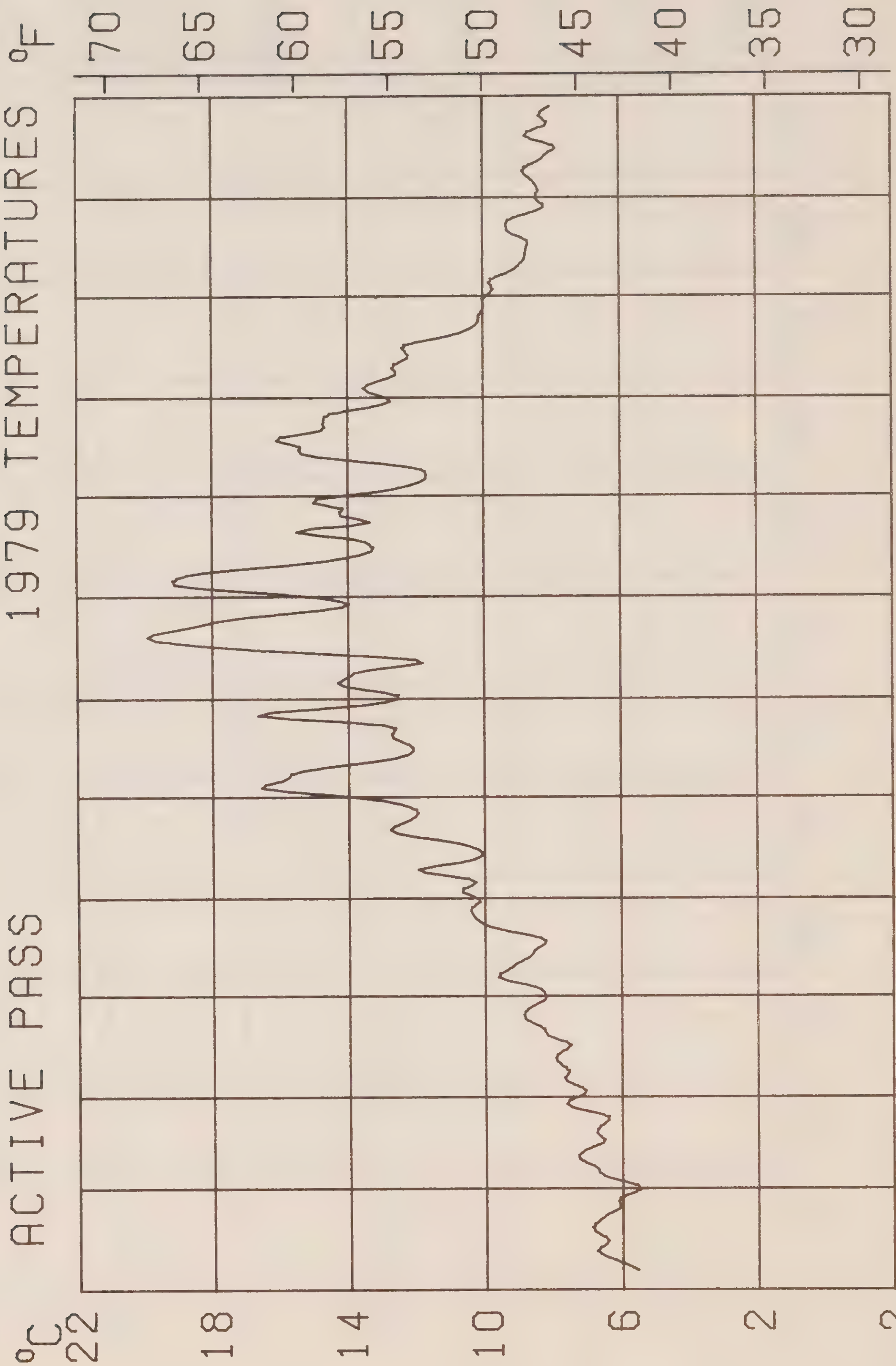
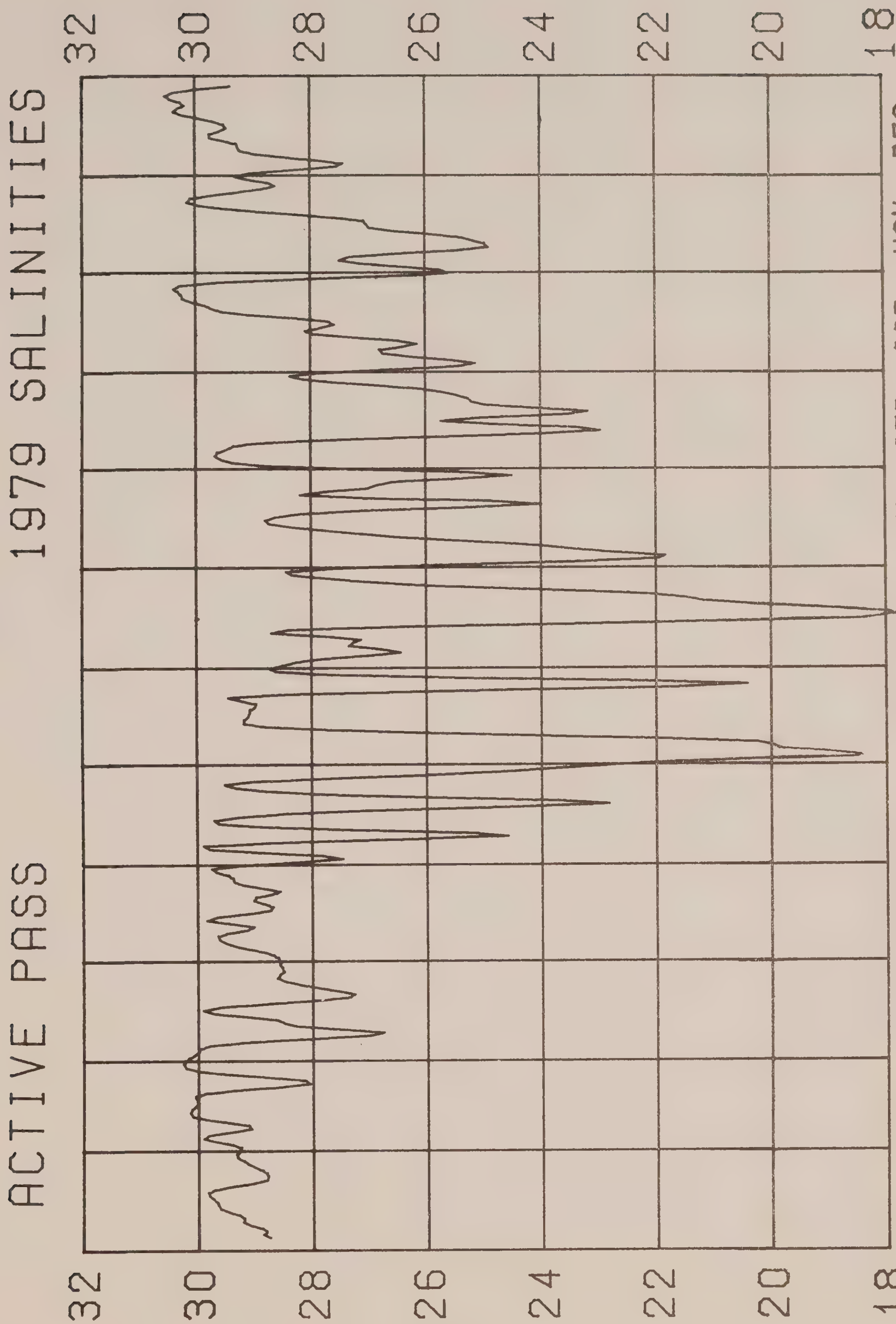
30
28
26
24
22
20
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


WEST VANCOUVER 1979 TEMPERATURES
°F
70
65
60
55
50
45
40
35
30
°C
22
18
14
10
6
2
-2
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


ACTIVE PASS
1979 TEMPERATURES
°F
70
65
60
55
50
45
40
35
30
°C
22
18
14
10
6
2
-2
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC


ACTIVE PASS 1979 SALINITIES
32
30
28
26
24
22
20
18
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

Pacific Marine Science Report 81-24 (Part 1)

+ Pt. 2

OCEANOGRAPHIC OBSERVATIONS AT OCEAN STATION P

11 January 1980 - 25 June 1981
VOLUMES 106 TO 118

Institute of Ocean Sciences
Sidney, B.C.

CA1 EP321
Pacific Marine Science Report 81-24 (Part 1) - 81R24

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1981

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P.O. Box 6000

Sidney, B.C. CANADA

V8L 4B2

ABSTRACT

Physical, chemical and biological oceanographic observations are made from the weathership at Ocean Weather Station Papa, and between Esquimalt and Station Papa, on a routine continuing basis. Physical oceanographic observations only, taken during January 1980 through June 1981 are shown, including surface observations and profiles obtained with bottle casts and conductivity-temperature-pressure instruments.

INTRODUCTION

Canadian operation of Ocean Weather Station P (Latitude 50°00'N, Longitude 145°00'W) was inaugurated in December 1950. The station is occupied primarily to make meteorological observations of the surface and upper air and to provide an air-sea rescue service. The station is manned by two vessels operated by the Marine Services Branch of the Ministry of Transport. They are the CCGS Vancouver and the CCGS Quadra. Each ship remains on station for a period of six weeks, and is then relieved by the alternate ship, thus maintaining a continuous watch.

Bathythermograph observations have been made at Station P since July 1952. A program of more extensive oceanographic observations commenced in August 1956. This was extended in April 1959 by the addition of a series of oceanographic stations along the route to and from Station P and Swiftsure Bank. These stations are known as Line P stations. The number of stations on Line P has been increased twice and now consists of twelve stations (Fig. 1). Bathythermograph observations and surface salinity sample collections. in addition to being made on Line P oceanographic stations, are also made at odd meridians at 40°, i.e. 139°40'W, 141°40;W, etc. These stations are known as Line P BT stations. Data prior to 1968 has been indexed by Collins et al. (1969).

All physical oceanographic data have been stored by the Marine Environmental Data Services Branch (MEDS), Department of Fisheries and Oceans, 240 Sparks Street, 7th Floor West, Ottawa, Ontario, Canada, K1A 0E6. Requests for these data should be directed to MEDS.

Biological and productivity data are published in the Manuscript Report series of the Department of Fisheries and Oceans (DFO), Pacific Biological Station, Nanaimo, British Columbia, Canada. Requests for these data should be directed to DFO.

Marine geochemical data are for the Ocean Chemistry Division, Department of Fisheries and Oceans, Institute of Ocean Sciences, P.O. Box 6000, Sidney, B.C., Canada, V8L 4B2.

This is the last volume of an oceanographic data report series comprised of data collected at Station P and Line P. The first of the series started in 1956.

All previously issued data reports, up to and incuding volume 105 (cruise 79-009 from 30 November 1979 to 17 January 1980) were entirely in printed form.

(continued)

INTRODUCTION (Continued)

Since that time 13 additional cruises were made until the termination of the weatherships on 25 June 1981.

Due to the rising cost of printing, the last 13 volumes covering the time from 11 January 1980 to 25 June 1981 (volume 106 to 118) have been incorporated into one volume and produced "cover to cover" in microfiche (found in pockets at the back of this volume).

For easy reference, only a summary and the log of hydrographic and STD observations are printed and form a part of this volume.

It is hoped that in the future a report consisting of errata notes indicating possible errors in previously printed data reports will be issued.

VOLUME NUMBER AND CRUISE SCHEDULE

VOLUME	CRUISE I.D.	SHIP (CCGS)	DATE	OBSERVER	
106	80-001	QUADRA	11 Jan - 28 Feb '80	R. Bellegay	(IOS)
				R. Conway	(OSU)
107	80-002	VANCOUVER	22 Feb - 10 Apr '80	M. Sherlock	(OSU)
108	80-003	QUADRA	04 Apr - 22 May '80	B. Minkley	(IOS)
				H. Batchelder	(OSU)
109	80-004	VANCOUVER	16 May - 03 JUL '80	R. Conway	(OSU)
110	80-005	QUADRA	27 Jun - 14 Aug '80	B. Canning	(IOS)
				M. Sherlock	(OSU)
111	80-006	VANCOUVER	08 Aug - 25 Sep '80	H. Batchelder	(OSU)
112	80-007	QUADRA	19 Sep - 06 Nov '80	H. Ashton	(contract)
				R. Conway	(OSU)
113	80-008	VANCOUVER	31 Oct - 18 Dec '80	R. Bigham	(IOS)
				M. Sherlock	(OSU)
114	80-009	QUADRA	12 Dec'80 - 22 Jan '81	H. Ashton	(contract)
				H. Batchelder	(OSU)
115	81-001	VANCOUVER	16 Jan - 26 Feb '81	R. Conway	(OSU)
116	81-002	QUADRA	20 Feb - 02 Apr '81	G. Jewsbury	(contract)
				M. Sherlock	(OSU)
117	81-003	VANCOUVER	27 Mar - 14 May '81	Ships crew	
118	81-004	QUADRA	08 May - 25 Jun '81	H. Ashton	(contract)

(IOS) Institute of Ocean Sciences.
(OSU) Oregon State University.

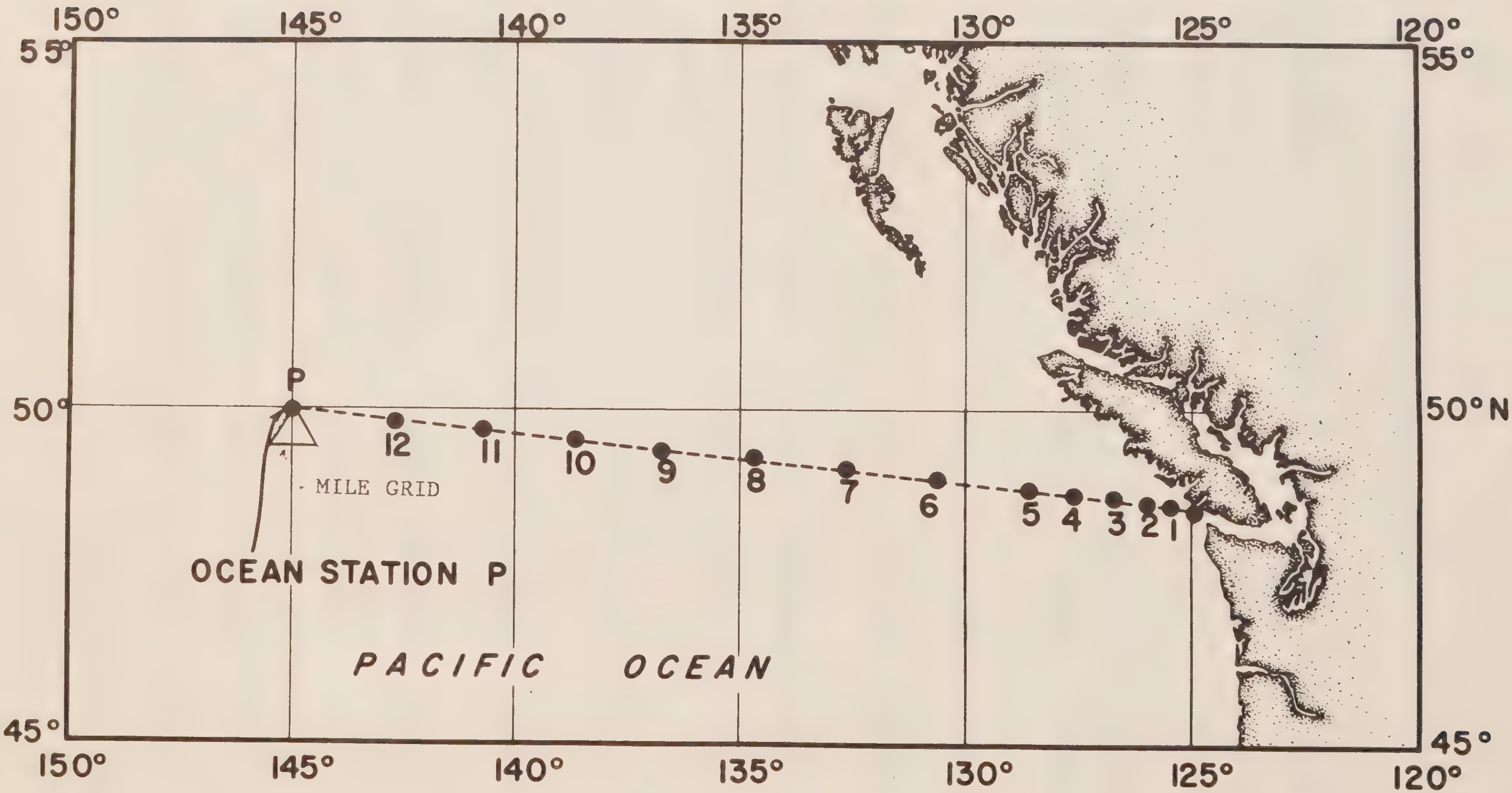

Chart showing Line P station positions.

PROGRAM OF OBSERVATION FROM CCGS QUADRA, 11 January - 28 February 1980 (P-80-1)(MEDS Ref. No. 15-80-001)

En route to Station P (Line P)

A STD profile was taken at Line P Station 12.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT stations 1, 2, 3, 4, 6-1/2, 7, 7-1/2, 9 and 9-1/2.

On Station P

The oceanographic program was carried out as follows:

Physical Oceanography:

1) Two hydrocasts to 4200 metres for temperature, salinity and oxygen.
Two hydrocasts to 1500 metres for temperature, salinity and oxygen.
One hydrocast to 1200 metres for temperature, salinity and oxygen.
One hydrocast to 1500 metres for temperature and POC (Particulate and Organic Carbon)
One hydrocast to 500 metres for temperature, salinity and tritium.

2) Sixty STD profiles were taken at Station P.
Fifteen STD profiles were taken at MILE GRID positions.
Eight STD profiles were taken off station.

3) Daily salinity samples were taken from the seawater loop at 0000 hours, GMT.

4) The regular 3-hourly BT observations were deleted during this cruise. The temperature profiles only of all STD's taken at Station P were digitized and transmitted according to the IGOSS format.

Marine Geochemistry

Samples for air CO_2, PCO_2, POC, alkalinity, nutrients and tritium obtained during this cruise are for the Ocean Chemistry Division and are not included in this data report.

Biological Oceanography

Samples from 150 metre vertical plankton hauls (Station P) and nutrients (Line P) obtained during this cruise are for the Pacific Biological Station and are not included in this data report.

En Route from Station P (Line P)

STD profiles were taken at Line P stations 12, 7, 6, 3, 2 and 1.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
001	12	14/01/80	1800	300		Line P
002		14/01/80	2340	300		49°45N 143°13W
003	P	19/01/80	1730	300		
004	E3	19/01/80	1850	300		Temp only
005	E4	19/01/80	2020	300		Temp only MILE
006	C1	19/01/80	2140	300		Temp only grid
007	W4	19/01/80	2325	300		Temp only
008	W3	20/01/80	0055	300		
009	P	20/01/80	0215	300		
010	P	20/01/80	1720	300		
011	P	20/01/80	2340	300		
012	P	21/01/80	1835	1300		
013	P	21/01/80	2355	300		
014	P	22/01/80	1730	1400		
015	P	22/01/80	2330	300		
016	P	23/01/80	1725	1425		
017	P	23/01/80	2032		4200	T,S,O_2
018	P	23/01/80	2335	300		
019		25/01/80	1720	1425		50°00N 147°18W
020		25/01/80	2335	300		50°05N 147°23W
021		26/01/80	1735	300		49°58N 147°21W
022		26/01/80	2340	300		49°57N 147°26W
023		27/01/80	1725	1425		49°58N 147°24W
024		27/01/80	2340	300		49°46N 147°04W
025		28/01/80	1715	300		48°58N 145°46W
026	P	29/01/80	0108	300		
027	P	29/01/80	1725	1425		
028	P	20/01/80			1200	T,S,O_2
029	P	29/01/80	2330	300		
030	P	30/01/80	1735	300		
031	P	30/01/80	2345	300		
032	P	31/01/80	1720	300		
033	P	31/01/80	2330	300		
034	P	01/02/80	1730	300		
035	P	01/02/80	2330	300		
036	P	02/02/80	1720	1425		
037	E3	02/02/80	1938	300		
038	E4	02/02/80	2120	300		MILE
039	C1	02/02/80	2315	300		grid
040	W4	03/02/80	0110	300		
041	W3	03/02/80	0237	300		
042	P	03/02/80	0350	300		
043	P	03/02/80	1720	300		
044	P	03/02/80	2335	300		
045	P	05/02/80	1720	1425		
046	P	05/02/80	1920		1500	$T,S.O_2$
047	P	05/02/80	2330	300		
048	P	06/02/80	1750	1425		
049	P	06/02/80	2332	300		
050	P	07/02/80	1720	1425		
051	P	07/02/80	2334	300		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
052	P	08/02/80	1720	1325		
053	P	08/02/80	2330	300		
054	P	11/02/80	1725	300		
055	P	11/02/80	2335	300		
056	P	12/02/80	1720	1425		
057	P	12/02/80	2330	300		
058	P	13/02/80	1725	1425		
059	P	13/02/80	2027		4200	T,S.O_2
060	P	13/02/80	2335	300		
061	P	14/02/80	1730	1425		
062	P	14/02/80	2336	300		
063	P	15/02/80	1730	1425		
064	P	15/02/80	1835		500	T.S. Tritium
065	P	16/02/80	0045	300		
066	P	16/02/80	1730	1425		
067	P	16/02/80	1812		1500	T, POC
068	P	17/02/80	0015	300		
069	P	17/02/80	1720	1425		
070	P	17/02/80	2348	300		
071	P	18/02/80	1720	1425		
072	P	18/02/80	1855		1500	T,S,O_2
073	P	19/02/80	1725	1425		
074	E3	19/02/80	1900	300		MILE grid
075	E4	19/02/80	2010	300		
076	C1	19/02/80	2145	300		
077	W4	19/02/80	2330	300		
078	W3	20/02/80	0050	300		
079	P	20.02.80	0215	300		
080	P	20/02/80	1710	1425		
081	P	20/02/80	2333	300		
082	P	21/02/80	1725	1425		
083	P	21/02/80	2323	300		
084	P	23/02/80	1730	1425		
085	12	24/02/80	1715	1425		Line P
086	7	26/02/80	0635	1425		
087	6	26/02/80	1315	1200		
088	3	27/02/80	1938	1300		
089	2	27/02/80	0535	100		
090	1	27/02/80	0715	100		

PROGRAM OF OBSERVATION FROM CCGS VANCOUVER, 22 February - 10 April 1980 (F-80-2) (MEDS Ref. No. 15-80-002)

En route to Station P (Line P)

STD profiles were taken at Line P stations 1 to 7 and 10.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 8-1/2, 9, 9-1/2, 10-1/2 and 11.

On Station P

The oceanographic program was carried out as follows:

Physical Oceanography:

1) Six hydrocasts to 1200 metres for temperature and salinity

2) Seventy-three STD profiles were taken at Station P. Fifteen STD profiles were taken at MILE GRID positions.

3) Daily salinity samples were taken from the seawater loop at 0000 hours, GMT.

4) The regular 3-hourly BT observations were deleted during this cruise. The temperature profiles only of all STD's taken at Station P were digitized and transmitted according to the IGOSS format.

Marine Geochemistry

Samples for air CO_2, PCO_2, POC, alkalinity, nutrients and tritium obtained during this cruise are for the Ocean Chemistry Division and are not included in this data report.

Biological Oceanography

Samples from 150 metre vertical plankton hauls (Station P) and nutrients (Line P) obtained during this cruise are for the Pacific Biological Station and are not included in this data report.

En Route from Station P (Line P)

STD profiles were taken at Line P station 12.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 1, 2, 9-1/2, 10, 10-1/2, 11 and 11-1/2.

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
001	1	22/02/80	1645	110		
002	2	23/02/80	0230	110		
003	3	23/02/80	0430	1200		
004	4	23/02/80	1820	1200		
005	5	23/02/80	1145	1200		Line P
006	6	23/02/80	1820	1200		
007	7	24/02/80	0100	1200		
008	10	24/02/80	1940	1200		
009	P	25/02/80	1900	1200		
* 010	P	25/02/80	1915	300		
011	W3	25/02/80	2040	300		
012	W4	25/02/80	2220	300		MILE
013	C1	26/02/80	0015	300		grid
014	E4	26/02/80	0220	300		
015	E3	26/02/80	0430	300		
016	P	26/02/80	1730	1200		
017	P	26/02/80	1830		1200	T,S,
018	P	26/02/80	2325	300		
019	P	27/02/80	1720	1200		
020	P	28/02/80	0000	300		
021	P	28/02/80	1730	1200		
022	P	28/02/80	2345	300		
023	P	29/02/80	1745	1200		
* 024	P	01/03/80	0000	120		
* 025	P	01/03/80	1600	170		
026	P	02/03/80	0000	1200		
027	P	02/03/80	1700	1200		
028	P	03/03/80	0000	300		
029	P	03/03/80	1700	1200		
030	P	04/03/80	1700	1200		
† 031	P	04/03/80	2136		1200	T.S.
032	P	05/03/80	0000	300		
033	P	05/03/80	1700	1200		
034	P	06/03/80	0000	300		
035	P	06/03/80	1700	1200		
036	P	07/03/80	0000	300		
037	P	07/03/80	1700	1200		
038	P	08/03/80	0000	300		
039	P	08/03/80	1700	1200		
040	P	09/03/80	0000	300		
041	P	09/03/80	1700	1200		
042	P	10/03/80	0000	300		
043	P	10/03/80	1620	300		
044	P	11/03/80	0000	300		
045	P	11/03/80	1700	1200		
046	P	12/03/80	0000	300		
047	P	12/03/80	1730	1200		
048	P	12/03/80	1845		1200	T,S,
049	P	13/03/80	0000	300		
050	P	13/03/80	1730	1200		
051	P	14/03/80	0000	300		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
052	P	14/03/80	1800	1200		
053	P	15/03/80	0000	300		
054	P	15/03/80	1600	1350		
055	P	15/03/80	1620	300		
056	E3	15/03/80	1815	300		
057	E4	15/03/80	2030	300		
058	C1	15/03/80	2230	300		MILE
059	W4	16/03/80	0100	300		grid
060	W3	16/03/80	0230	300		
061	P	16/03/80	1700	1200		
062	P	17/03/80	1700	1200		
063	P	18/03/80	0000	300		
064	P	18/03/80	1700	1200		
065	P	18/03/80	1820		1200	T,S,
066	P	19/03/80	0000	300		
067	P	20/03/80	1700	1200		
068	P	21/03/80	0000	300		
069	P	21/03/80	1930	1200		
070	P	22/03/80	0000	300		
071	P	22/03/80	1700	1200		
072	P	23/03/80	0000	300		
073	P	23/03/80	1700	1200		
074	P	24/03/80	0000	300		
075	P	25/03/80	0000	1200		
076	P	25/03/80	1700	1200		
077	P	25/03/80	1808		1200	T,S,(200-1200 m)
078	P	26/03/80	0000	300		
079	P	26/03/80	1700	1200		
077	P	26/03/80	1857		175	(0 to 175 m)
080	P	27/03/80	1800	300		
081	P	28/03/80	0000	1200		
082	P	28/03/80	1830	1200		
083	P	29/03/80	0000	300		
084	P	30/03/80	0000	1200		
085	P	30/03/80	1700	1200		
086	P	31/03/80	0000	300		
087	P	31/03/80	1700	1200		
088	P	01/04/80	1700	1200		
089	E3	01/04/80	1930	300		
090	E4	01/04/80	2130	300		
091	C1	01/04/80	2330	300		MILE
092	W4	02/04/80	0130	300		grid
093	W3	02/04/80	0330	300		
094	P	02/04/80	1700	1200		
095	P	02/04/80	1925		1200	T,S,
096	P	03/04/80	0000	300		
097	P	03/04/80	1700	1200		
098	P	04/04/80	0000	300		
099	P	04/04/80	1700	1200		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
100	P	05/04/80	0000	300		
101	P	05/04/80	1700	1200		
102	P	06/04/80	0000	300		
103	12	06/04/80	2300	1200		Line P

PROGRAM OF OBSERVATION FROM CCGS QUADRA, 4 April - 22 May, 1980 (P-80-3) (MEDS Ref. No. 15-80-003)

En route to Station P (Line P)

STD profiles were taken at Line P station 5.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 5-1/2, 6, 6-1/2, 7-1/2, 9, 9-1/2 and 12.

On Station P

The oceanographic program was carried out as follows:

Physical Oceanography:

1) Two hydrocasts to 4200 metres for temperature, salinity and oxygen.
   Four hydrocasts to 1500 metres for temperature, salinity and oxygen.
   Four hydrocasts to 1500 metres for temperature, P.O.C. (Particulate Organic Carbon and Chlorophyll -a).

2) Sixty-eight STD profiles were taken at Station P.
   Fifteen STD profiles were taken at MILE GRID positions.

3) Daily salinity samples were taken from the seawater loop at 0000 hours, GMT.

4) The regular 3-hourly BT observations were deleted during this cruise.
   The temperature profiles only of all STD's taken at Station P were digitized and transmitted according to the IGOSS format.

Marine Geochemistry

Samples for air CO_2, PCO_2, POC, alkalinity, nutrients and tritium obtained during this cruise are for the Ocean Chemistry Division and are not included in this data report.

Biological Oceanography

Samples from 150 metre vertical plankton hauls (Station P) and nutrients (Line P) obtained during this cruise are for the Pacific Biological Station and are not included in this data report.

En Route from Station P (Line P)

STD profiles were taken at Line P station 12 to 2. At stations 5 and 1 a hydrocast at each station was made for temperature and salinity.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 5, 6-1/2, 7-1/2, 8-1/2, 10-1/2, 11-1/2

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
001	5	05/04/80	1439	1400		Line P
002	P	08/04/80	2331	300		
003	P	09/04/80	1715	1400		
004	P	09/04/80	2330	300		
005	P	10/04/80	1724	1400		
006	P	10/04/80	1817		1500	T, POC, Chl a
007	P	11/04/80	0000	300		
008	P	11/04/80	1721	1400		
009	P	11/04/80	2333	300		
010	P	12/04/80	1745	1400		
011	E3	12/04/80	1920	300		
012	E4	12/04/80	2050	300		
013	C1	12/04/80	2336	300		MILE
014	W4	13/04/80	0100	300		grid
015	W3	13/04/80	0230	300		
016	P	13/04/80	0345	300		
017	P	13/04/80	1730	1400		
018	P	13/04/80	1853		1500	T,S,O_2
019	P	13/04/80	2328	300		
020	P	14/04/80	1721	1400		
021	P	15/04/80	1721	1400		
022	P	15/04/80	2330	300		
023	P	16/04/80	1728	1400		
024	P	16/04/80	1815		4200	(T,S,O_2, Alk.,C_{13}.
025	P	16/04/80	2323	300		(nutrients
026	P	17/04/80	1717	1400		
027	P	17/04/80	2330	300		
028	P	18/04/80	1718	1400		
029	P	18/04/80	2333	300		
030	P	20/04/80	1720	1500		
031	P	20/04/80	1826		1500	T,S,O_2
032	P	20/04/80	2330	300		
033	P	21/04/80	1719	1400		
034	P	21/04/80	2325	300		
035	P	22/04/80	1719	1400		
036	P	22/04/80	2330	300		
037	P	24/04/80	1723	1400		
038	P	24/04/80	1810		1500	T, POC, chl a
039	P	24/04/80	2330	300		
040	P	25/04/80	1734	1400		
041	P	25/04/80	1927	300		
042	E3	25/04/80	2052	300		MILE
043	E4	25/04/80	2326	300		grid
044	C1	26/04/80	0125	300		
045	W4	26/04/80	0307	300		
046	W3	26/04/80	1925	1400		
047	P	26/04/80	2317	300		
048	P	27/04/80	1749	1400		
049	P	27/04/80	1854		1500	T,S,O_2
050	P	27/04/80	2327	300		
051	P	28/04/80	1722	1400		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
052	P	28/04/80	2327	300		
053	P	29/04/80	1725	1400		
054	P	29/04/80	2335	300		
055	P	30/04/80	1722	1400		
056	3	30/04/80	2324	300		
057	4	01/05/80	1724	1400		
058	1	01/05/80	1805		1500	T, POC, Chl a
059	4	01/05/80	2325	300		
060	3	02/05/80	1718	1400		
061	P	02/05/80	2326	300		
062	P	03/05/80	1744	300		
063	P	04/05/80	1716	1400		
064	P	04/05/80	2323	300		
065	P	05/05/80	1721	1400		
066	P	05/05/80	2139		1500	T,S,O_2
067	P	05/05/80	2216	300		
068	P	06/05/80	1718	1400		
069	P	06/05/80	2330	300		
070	P	07/05/80	1721	1400		
071	P	07/05/80	2327	300		
072	P	08/05/80	1725	1200		
073	P	08/05/80	2315	300		
074	P	09/05/80	1723	1400		
075	P	09/05/80	1912		1500	T, POC, Chl a
076	P	09/05/80	2324	300		
077	P	10/05/80	1715	1400		
078	P	10/05/80	2322	300		
079	P	11/05/80	1718	1400		
080	P	11/05/80	1832		4200	T,S,O_2
081	P	11/05/80	2327	300		
082	P	12/05/80	1728	1400		
083	P	12/05/80	2321	300		
084	P	13/05/80	1720	1400		
085	P	13/05/80	2328	300		
086	P	14/05/80	1717	1400		
087	E3	14/05/80	1921	300		
088	E4	14/05/80	2052	300		
089	C1	14/05/80	2218	300		MILE
090	W4	14/05/80	2352	300		grid
091	W3	15/05/80	0116	300		
092	P	15/05/80	0235	300		
093	P	15/05/80	1725	1400		
094	P	17/05/80	1720	1400		
095	12	18/05/80	1717	1400		
096	11	19/05/80	0405	1400		
097	10	19/05/80	0953	1400		
098	9	19/05/80	1533	1400		
099	8	19/05/80	2118	1400		
100	7	20/05/80	0254	1400		Line P

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)		Comments
101	6	20/05/80	0837	1400			Line P
102	5	20/05/80	1438	1400			
103	5	20/05/80	1540		1500	T,S,	
104	4	20/05/80	1853	1400			
105	3	20/05/80	2206	1200			
* 106	2	21/05/80	0145	100		not digitized	
107	1	21/05/80	0404		100	T,S,	

PROGRAM OF OBSERVATION FROM CCGS VANCOUVER, 16 May - 3 July 1980 (P-80-4)
(MEDS Ref. No. 15-80-004)

En route to Station P (Line P)

STD profiles were taken at Line P stations 1 to 7, 9 and 12.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 5-1/2, 6-1/2, 8-1/2, and 11-1/2.

On Station P

The oceanographic program was carried out as follows:

Physical Oceanography:

1) Seven hydrocasts to 1200 metres for temperature, salinity and oxygen. One hydrocasts to 1500 metres for temperature, salinity and oxygen.

2) Eighty four STD profiles were taken at Station P. Fifteen STD profiles were taken at MILE GRID positions.

3) Daily salinity samples were taken from the seawater loop at 0000 hours, GMT.

4) The regular 3-hourly BT observations were deleted during this cruise. The temperature profiles only of all STD's taken at Station P were digitized and transmitted according to the IGOSS format.

Marine Geochemistry

Samples for air CO_2, PCO_2, POC, alkalinity, nutrients and tritium obtained during this cruise are for the Ocean Chemistry Division and are not included in this data report.

Biological Oceanography

Samples from 150 metre vertical plankton hauls (Station P) and nutrients (Line P) obtained during this cruise are for the Pacific Biological Station and are not included in this data report.

En Route from Station P (Line P)

STD profiles were taken at Line P stations 1 to 6.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 10, 10-1/2, 11 and 12.

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
001	1	17/05/80	0120	115		
002	2	17/05/80	0372	110		
003	3	17/05/80	0515	1200		
004	4	17/05/80	0835	1200		
005	5	17/05/80	1210	1200		Line P
006	6	17/05/80	1852	1200		
007	7	18/05/80	0118	1200		
008	7-1/2	18/05/80	0731	1200		
009	9	18/05/80	1352	1200		
010	12	19/05/80	0845	1200		
011	P	19/05/80	1745	1270		
012	P	20/05/80	0010	300		
013	P	20/05/80	1710	1200		
014	P	20/05/80	1925		1200	T,S,O_2
015	P	21/05/80	0000	300		
016	P	21/05/80	1725	1200		
017	P	22/05/80	0000	300		
018	P	22/05/80	1600	1200		
019	P	22/05/80	1610	300		
020	E3	22/05/80	1820	300		
021	E4	22/05/80	2030	300		
022	C1	22/05/80	2230	300		MILE
023	W4	23/05/80	0030	300		grid
024	W3	23/05/80	0235	300		
025	P	23/05/80	1710	1200		
026	P	23/05/80	2100		1200	T,S,O_2
027	P	23/05/80	2220	300		
028	P	24/05/80	1715	1200		
029	P	24/05/80	2350	300		
030	P	25/05/80	1710	1200		
031	P	26/05/80	0000	300		
032	P	26/05/80	1725	1200		
033	P	27/05/80	0005	300		
034	P	27/05/80	1713	1200		
035	P	27/05/80	1815		1200	T,S,O_2
036	P	28/05/80	0001	300		
037	P	28/05/80	1705	1200		
038	P	29/05/80	0005	300		
039	P	29/05/80	1715	1200		
040	P	29/05/80	2357	300		
041	P	30/05/80	1715	1200		
042	P	30/05/80	2350	300		
043	P	31/05/80	1715	1200		
044	P	31/05/80	2355	300		
045	P	01/06/80	1715	1200		
046	P	01/06/80	2353	300		
047	P	02/06/80	1725	1200		
048	P	02/06/80	2353	300		
049	P	03/06/80	1710	1200		
050	P	03/06/80	1825		1200	T,S,O_2

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
051	P	04/06/80	0002	300		
052	P	04/06/80	1710	1200		
053	P	04/06/80	2355	300		
054	P	05/06/80	1708	1200		
055	P	05/06/80	2350	300		
056	P	06/06/80	1547	1200		MILE grid
057	E3	06/06/80	1815	300		
058	E4	06/06/80	2047	300		
059	C1	06/06/80	2135	300		
060	W4	06/06/80	2333	300		
061	W3	07/06/80	0210	300		
062	P	07/06/80	1712	1200		
063	P	07/06/80	2201	300		
064	P	08/06/80	1723	1200		
065	P	08/06/80	2347	300		
066	P	09/06/80	1720	1200		
067	P	09/06/80	2351	300		
068	P	10/06/80	1718	1200		
069	P	10/06/80	2351	300		
070	P	11/06/80	1714	1200		
071	P	11/06/80	1800		1500	T,S,O_2
072	P	11/06/80	2355	300		
073	P	12/06/80	1720	1200		
074	P	12/06/80	2351	300		
075	P	13/06/80	1717	1200		
076	P	13/06/80	2348	300		
077	P	14/06/80	1715	1200		
078	P	14/06/80	2150		1200	T,S,O_2
079	P	14/06/80	2210	300		
080	P	15/06/80	1715	1200		
081	P	15/06/80	2351	300		
082	P	16/06/80	1710	1200		
083	P	16/06/80	1816		1200	T,S,O_2
084	P	16/06/80	2350	300		
085	P	17/06/80	1715	1200		
086	P	17/06/80	2353	300		
087	P	18/06/80	1709	1200		
088	P	18/06/80	2348	300		
089	P	19/06/80	1711	1200		
090	P	20/06/80	0001	300		
091	P	20/06/80	1710	1200		
092	P	20/06/80	2217	300		
093	P	21/06/80	1733	1200		
094	P	21/06/80	2357	300		
095	P	22/06/80	1736	1200		
096	P	22/06/80	2230	300		
097	P	23/06/80	1710	1200		
098	P	23/06/80	1826		1200	T,S,O_2
099	P	23/06/80	2350	300		
100	P	24/06/80	1708	1200		
101	P	24/06/80	2351	300		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
102	P	25/06/80	1712	1200		
103	P	25/06/80	2356	300		
104	P	26/06/80	1711	1200		MILE grid
105	E3	26/06/80	1923	300		MILE grid
106	E4	26/06/80	2132	300		MILE grid
107	C1	26/06/80	2357	300		MILE grid
108	W4	27/06/80	0207	300		MILE grid
109	W3	27/06/80	0425	300		MILE grid
110	P	27/06/80	1709	1200		
111	P	27/06/80	2350	300		
112	P	28/06/80	1710	1200		
113	P	28/06/80	2347	300		
114	P	29/06/80	1709	1200		
115	P	30/06/80	0004	300		
116	P	30/06/80	1714	1200		
117	P	30/06/80	2323	300		
118	6	02/07/80	1548	1200		Line P
119	5	02/07/80	2205	1200		Line P
120	4	03/07/80	0130	1200		Line P
121	3	03/07/80	0432	1200		Line P
122	2	03/07/80	0645	100		Line P
123	1	03/07/80	0835	100		Line P

PROGRAM OF OBSERVATION FROM CCGS QUADRA, 27 June - 14 August 1980 (P-80-5)
(MEDS Ref. No. 15-80-005)

En route to Station P (Line P)

STD profiles were taken at Line P station 12.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 1, 2, 4, 5-1/2, 6, 7, 7-1/2, 8-1/2 and 11-1/2.

On Station P

The oceanographic program was carried out as follows:

Physical Oceanography:

1) Two hydrocasts to 4200 metres for temperature, salinity and oxygen. Four hydrocasts to 1500 metres for temperature, salinity and oxygen.

2) Seventy eight STD profiles were taken at Station P. Fifteen STD profiles were taken at MILE GRID positions.

3) Daily salinity samples were taken from the seawater loop at 0000 hours, GMT.

4) The regular 3-hourly BT observations were deleted during this cruise. The temperature profiles only of all STD's taken at Station P were digitized and transmitted according to the IGOSS format.

Marine Geochemistry

Samples for air CO_2, PCO_2, POC, alkalinity, nutrients and tritium obtained during this cruise are for the Ocean Chemistry Division and are not included in this data report.

Biological Oceanography

Samples from 150 metre vertical plankton hauls (Station P) and nutrients (Line P) obtained during this cruise are for the Pacific Biological Station and are not included in this data report.

En Route from Station P (Line P)

STD profiles were taken at Line P stations 12, 5, 4, 3 and 2. At stations 12 and 15 a hydrocast was also made for temperature and salinity.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 1 and 5-1/2.

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
001	12	01/07/80	2125	1425		Line P
002	P	02/07/80	1720	1425		
003	P	03/07/80	0150	300		
004	P	03/07/80	1725	1425		
005	P	03/07/80	1829		1500	T,S.O_2
006	P	03/07/80	2320	300		
007	P	04/07/80	1730	1425		
008	P	04/07/80	2320	300		
009	P	05/07/80	1720	1425		
010	E3	05/07/80	1930	300		
011	E4	05/07/80	2055	300		MILE
012	C1	05/07/80	2215	300		grid
013	W4	05/07/80	2335	300		
014	W3	06/07/80	0055	300		
015	P	06/07/80	0212	300		
016	P	06/07/80	1730	1425		
017	P	06/07/80	2330	300		
018	P	07/07/80	1720	1425		
019	P	07/07/80	2320	300		
020	P	08/07/80	1720	1425		
021	P	08/07/80	1825		4200	T,S,O_2
022	P	08/07/80	2320	300		
023	P	09/07/80	1745	1425		
024	P	09/07/80	2320	300		
025	P	10/07/80	1720	1425		
026	P	10/07/80	2323	300		
027	P	11/07/80	1720	1425		
028	P	11/07/80	2320	300		
029	P	12/07/80	1715	300		
030	P	12/07/80	2320	300		
031	P	13/07/80	1720	1425		
032	P	13/07/80	2320	300		
033	P	14/07/80	1720	1425		
034	P	14/07/80	1803		1500	T,S.O_2
035	P	14/07/80	2315	300		
036	P	15/07/80	1535	1425		
037	P	15/07/80	2320	300		
038	P	16/07/80	1715	1425		
039	P	16/07/80	2320	300		
040	P	17/07/80	1722	1425		
041	P	17/07/80	2315	300		
042	P	18/07/80	1713	300		
043	P	18/07/80	2320	300		
044	P	19/07/80	1715	1425		
045	E3	19/07/80	1925	300		
046	E4	19/07/80	2045	300		MILE
047	C1	19/07/80	2210	300		grid
048	W4	19/07/80	2332	300		
049	W3	20/07/80	0100	300		
050	P	20/07/80	0207	300		
051	P	20/07/80	1720	1425		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
052	P	20/07/80	2310	300		
053	P	21/07/80	1713	1425		
054	P	21/07/80	1757		1500	T,S,O_2
055	P	21/07/80	2312	300		
056	P	22/07/80	1715	1425		
057	P	22/07/80	2315	300		
058	P	23/07/80	1730	1425		
059	P	23/07/80	2325	300		
060	P	24/07/80	1715	1425		
061	P	24/07/80	2325	300		
062	P	25/07/80	1710	1425		
063	P	25/07/80	2315	300		
064	P	26/07/80	1720	1425		
065	P	26/07/80	2325	60		
066	P	27/07/80	1720	1425		
067	P	27/07/80	2315	300		
068	P	28/07/80	1810	1425		
069	P	28/07/80	2325	300		
070	P	29/07/80	1720	1425		
071	P	29/07/80	1807		4200	T,S,O_2
072	P	29/07/80	2315	300		
073	P	30/07/80	1540	300		
074	P	30/07/80	2330	300		
075	P	31/07/80	1720	1425		
076	P	31/07/80	2320	300		
077	P	01/08/80	1724	1425		
078	E3	01/08/80	1900	300		
079	E4	01/08/80	2010	300		
080	C1	01/08/80	2137	300		MILE
081	W4	01/08/80	2332	300		grid
082	W3	02/08/80	0055	300		
083	P	02/08/80	0212	300		
084	P	02/08/80	1715	1425		
085	P	02/08/80	2320	300		
086	P	03/08/80	1726	1425		
087	3	03/08/80	2315	300		
088	4	04/08/80	1720	1425		
089	1	04/08/80	1800		1500	T,S.O_2
090	4	04/08/80	2325	300		
091	3	05/08/80	1725	1425		
092	P	05/08/80	2320	300		
093	P	06/08/80	1715	1425		
094	P	06/08/80	2320	300		
095	P	07/08/80	1715	1425		
096	P	07/08/80	1215	300		
097	P	08/08/80	1715	300		
098	P	08/08/80	2320	300		
099	P	09/08/80	1715	1425		
100	P	09/08/80	2315	300		
101	12	10/08/80	1725	1425		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
102	12	10/08/80	1802		1500	LINE P
103	5	12/08/80	1440	1425		
104	5	12/08/80	1537		1500	
105	4	12/08/80	1842	1425		
106	3	12/08/80	2155	1200		
107	2	13/08/80	0100	100		

PROGRAM OF OBSERVATION FROM CCGS VANCOUVER, 8 August - 25 September 1980 (P-80-6) (MEDS Ref. No. 15-80-006).

En route to Station P (Line P)

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 10, 11 and 12.

On Station P

The oceanographic program was carried out as follows:

Physical Oceanography:

1) Five hydrocasts to 1200 metres for temperature, salinity and oxygen. Three hydrocasts to 300 metres for temperature and salinity.

2) Seventy two STD profiles were taken at Station P. Ten STD profiles were taken at MILE GRID positions.

3) Daily salinity samples were taken from the seawater loop at 0000 hours, GMT.

4) The regular 3-hourly BT observations were deleted during this cruise. The temperature profiles only of all STD's taken at Station P were digitized and transmitted according to the IGOSS format.

Marine Geochemistry

Samples for air CO_2, PCO_2, POC, alkalinity, nutrients and tritium obtained during this cruise are for the Ocean Chemistry Division and are not included in this data report.

Biological Oceanography

Samples from 150 metre vertical plankton hauls (Station P) and nutrients (Line P) obtained during this cruise are for the Pacific Biological Station and are not included in this data report.

En Route from Station P (Line P)

STD profiles were taken at Line P stations 1 to 12.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 5-1/2, 6-1/2, 7-1/2, 8-1/2, 9-1/2, 10-1/2, 11-1/2 and 12-1/2.

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
001	P	11/08/80	1720	1200		
002	W3	11/08/80	1910	300		
003	W4	11/08/80	2107	300		
004	C1	11/08/80	2310	300		MILE
005	E4	12/08/80	0048	300		grid
006	E3	12/08/80	0315	300		
007	P	12/08/80	1724	1300		
008	P	12/08/80	2245	300		
009	P	13/08/80	1730	1200		
010	P	13/08/80	1835		1200	T,S,O_2
011	P	13/08/80	2310	300		
012	P	14/08/80	1715	1200		
013	P	14/08/80	1803		300	T,S, Chl a
014	P	14/08/80	2310	300		
015	P	15/08/80	1725	1200		
016	P	15/08/80	2308	300		
017	P	16/08/80	1715	1200		
018	P	15/08/80	2308	300		
019	P	17/08/80	1715	1200		
020	P	17/08/80	2310	300		
021	P	18/08/80	1710	1200		
022	P	18/08/80	1757		1200	T,S,O_2
023	P	18/08/80	2315	300		
024	P	19/08/80	1715	1200		
025	P	19/08/80	2310	300		
026	P	20/08/80	1710	1200		
027	P	20/08/80	2310	300		
028	P	20/08/80	2320	300		
* 029	P	21/08/80	1710	1200		Temperature only
030	P	21/08/80	2315	300		
031	P	22/08/80	1725	1200		
032	P	22/08/80	2305	300		
033	P	23/08/80	1710	1200		
034	P	23/08/80	2310	300		
035	P	24/08/80	1715	1200		
036	P	24/08/80	1815		1200	T,S,O_2
037	P	24/08/80	2310	300		
038	P	25/08/80	1740	1200		
039	P	25/08/80	2305	300		
* 040	P	26/08/80	1710	1200		0 to 300 m wrong, sal.
041	P	26/08/80	1801		300	T,
042	P	26/08/80	2310	300		
* 043	P	27/08/80	1720	1200		sal. to 650 m only
044	P	27/08/80	2310	300		
* 045	P	28/08/80	1725	1200		sal. to 1070 m only
* 046	P	28/08/80	2310	300		Temperature only.
* 047	P	29/08/80	1720	1200		sal. to 650 m only
048	P	29/08/80	2310	300		
* 049	P	30/08/80	1720	1200		sal. to 650 m only
050	P	30/08/80	2308	300		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
* 051	P	31/08/80	1725	1200		sal. to 700 m only
052	E3	31/08/80	1908	300		MILE grid
053	E4	31/08/80	2050	300		
054	C1	31/08/80	2244	300		
055	W4	01/09/80	0035	300		
056	W3	01/09/80	0220	300		
* 057	P	01/09/80	1717	1200		sal. to 850 m only
058	P	01/09/80	1825		1200	T,S,O_2
059	P	01/09/80	2310	300		
060	P	02/09/80	1720	1200		
061	P	02/09/80	2310	300		
* 062	P	03/09/80	1710	1200		sal. to 600 m only
063	P	03/09/80	1756		300	T, Chl a
064	P	03/09/80	2310	300		
* 065	P	04/09/80	1710	1200		sal. to 980 m only
066	P	04/09/80	2310	300		
067	P	05/09/80	1720	1200		
068	P	05/09/80	2315	300		
069	P	06/09/80	1720	1200		
070	P	06/09/80	2310	300		
071	P	07/09/80	1725	1200		
072	P	07/09/80	2315	300		
073	P	08/09/80	1715	1200		
074	P	08/09/80	1800		1200	T,S,O_2
075	P	08/09/80	2310	300		
076	P	09/09/80	1720	1200		
077	P	09/09/80	2310	300		
078	P	10/09/80	1715	1200		
079	P	10/09/80	2315	300		
080	P	11/09/80	1715	1200		
081	P	11/09/80	2312	300		
* 082	P	12/09/80	1720	1200		sal. to 450 m only
083	P	12/09/80	2310	300		
084	P	13/09/80	1720	1200		
085	P	13/09/80	2315	300		
* 086	P	14/09/80	1720	1200		sal. to 590 m only
087	P	14/09/80	2310	300		
088	P	20/09/80	1715	1200		
089	P	20/09/80	1815		1200	T,S.O_2
090	P	20/09/80	2312	300		
091	12	21/09/80	2050	1200		Line P poor sal. trace
092	11	22/09/80	0350	1200		
093	10	22/09/80	0940	1200		
094	9	22/09/80	1530	1200		
095	8	22/09/80	2150	1200		
096	7	23/09/80	0410	1200		
097	6	23/09/80	1027	1200		
098	5	23/09/80	1645	1200		
099	4	23/09/80	2120	1200		
100	3	24/09/80	0045	1200		
101	2	24/09/80	0315	100		
102	1	24/09/80	0455	100		

PROGRAM OF OBSERVATION FROM CCGS QUADRA, 19 September - 6 November 1980 (P-80-7) (MEDS Ref. No. 15-80-007)

En route to Station P (Line P)

STD profiles were taken at Line P station 1, 2, 3, 8, 9, 11 and 12.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 4, 5, 5-1/2, 6, 6-1/2, 7, 7-1/2, 8-1/2, 9-1/2, 10 and 10-1/2.

On Station P

The oceanographic program was carried out as follows:

Physical Oceanography:

1) Two hydrocasts to 4200 metres for temperature, salinity and oxygen.
Four hydrocasts to 1500 metres for temperature, salinity and oxygen.
Seven hydrocasts to 300 metres for temperature and salinity.
Four hydrocasts to 300 metres for temperature, salinity, P.O.C. (Particulate Organic Carbon) and Chlorophyll a.

2) Twenty STD profiles were taken at Station P.
Five STD profiles were taken at MILE GRID positions.

3) Daily salinity samples were taken from the seawater loop at 0000 hours, GMT.

4) The regular 3-hourly BT observations were deleted during this cruise.
The temperature profiles only of all STD's taken at Station P were digitized and transmitted according to the IGOSS format.

Marine Geochemistry

Samples for air CO_2, PCO_2, POC, alkalinity, nutrients and tritium obtained during this cruise are for the Ocean Chemistry Division and are not included in this data report.

Biological Oceanography

Samples from 150 metre vertical plankton hauls (Station P) and nutrients (Line P) obtained during this cruise are for the Pacific Biological Station and are not included in this data report.

En Route from Station P (Line P)

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at all BT positions.

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
001	1	20/09/80	0210	100		
002	2	20/09/80	0350	100		
003	3	20/09/80	0621	1200		
004	8	21/09/80	0738	1350		LINE P
005	9	22/09/80	1407	300		
006	11	22/09/80	0158	1250		
007	12	22/09/80	0836	1200		
008	P	22/09/80	1723	1350		
009	P	22/09/80	1833		4200	T,S,O_2
010	P	22/09/80	2317	300		
011	P	23/09/80	1714	1200		
012	P	23/09/80	2327	300		
013	P	24/09/80	1716	1200		
* 014	P	24/09/80	1829		1500	(Depths 0, 300, 1500
015	E3	24/09/80	1955	300		(only.
016	E4	24/09/80	2129	300		
017	C1	24/09/80	2350	300		
018	W4	25/09/80	0023	300		MILE
019	W3	25/09/80	0130	300		grid
020	P	25/09/80	0240	300		
021	P	26/09/80	1755	1400		
**021	P	26/09/80	1905		300	T, POC, Chl <u>a</u>
022	P	26/09/80	2323	300		
023	P	27/09/80	1818	1400		
024	P	28/09/80	2323	300		
025	P	29/09/80	1724	1350		
026	P	29/09/80	1853		4200	T,S.O_2
027	P	29/09/80	2322	300		
028	P	30/09/80	1722	1350		
029	P	30/09/80	2311	300		
030	P	01/10/80	1720	1350		
031	P	01/10/80	2314	300		
032	P	02/10/80	1814	1200		
033	P	03/10/80	1719	1400		
034	P	08/10/80	1720	1200		
035	P	08/10/80	2322	300		
036	P	09/10/80	1718	1300		
037	P	09/10/80	1847		1500	T,S,O_2
038	P	16/10/80	0017		300	T,S, POC, Chl <u>a</u>
039	P	16/10/80	1824		1500	T,S,O_2
040	P	20/10/80	1756		1500	T,S,O_2
041	P	22/10/80	1805		300	T,S, POC, Chl <u>a</u>
042	P	23/10/80	1748		300	T,S.
043	P	24/10/80	2333		300	T,S.
044	P	25/10/80	1800		300	T,S.
045	P	26/10/80	1819		300	T,S.
046	P	27/10/80	1759		1500	T,S,O_2
047	P	28/10/80	1729		300	T,S.
048	P	29/10/80	1730		300	T,S.
049	P	31/10/80	1730		300	T,S, POC, Chl <u>a</u>
050	P	01/11/80	1726		300	T,S.

* not digitized   ** duplicate consecutive number

<u>PROGRAM OF OBSERVATION FROM CCGS VANCOUVER, 31 October - 18 December 1980 (P-80-8) (MEDS Ref. No. 15-80-008).</u>

En route to Station P (Line P)

A STD profile was taken at Line P Station 6.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 1, 2, 3, 4, 5, 5-1/2, 6-1/2, 8-1/2, 9, 10-1/2, and 11-1/2.

On Station P

The oceanographic program was carried out as follows:

Physical Oceanography:

1) One hydrocasts to 4200 metres for temperature and salinity.
Four hydrocasts to 1200 metres for temperature, salinity and oxygen.
One hydrocast to 1000 metres for temperature and salinity.
One hydrocast to 250 metres for temperature,salinity, oxygen and chlorophyll *a*.

2) Fifty four STD profiles were taken at Station P.
Twenty seven STD profiles were taken at MILE GRID positions.
Two STD profiles were taken off station.

3) Daily salinity samples were taken from the seawater loop at 0000 hours, GMT.

4) The regular 3-hourly BT observations were deleted during this cruise.
The temperature profiles only of all STD's taken at Station P were digitized and transmitted according to the IGOSS format.

Marine Geochemistry

Samples for air CO_2, PCO_2, POC, alkalinity, nutrients and tritium obtained during this cruise are for the Ocean Chemistry Division and are not included in this data report.

Biological Oceanography

Samples from 150 metre vertical plankton hauls (Station P) and nutrients (Line P) obtained during this cruise are for the Pacific Biological Station and are not included in this data report.

En Route from Station P (Line P)

STD profiles were taken at Line P stations 1 to 8 and 12. At station 1 a hydrocast was also made for temperature and salinity.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
001	6	01/11/80	2135	1200		Line P
002	P	04/11/80	1715	1200		
003	E3	04/11/80	1835	300		
004	C1	04/11/80	2004	300		
005	E4	04/11/80	2133	300		MILE
006	E101	04/11/80	2243	300		grid
007	S8	05/11/80	0022	300		
008	S7	05/11/80	0145	300		
009	W101	05/11/80	0307	300		
010	W4	05/11/80	0424	300		
011	W3	05/11/80	0545	300		
012	P	05/11/80	1707	1200		
013	P	05/11/80	2313	300		
014	P	06/11/80	1850	1200		
015	P	07/11/80	0100	300		
016	P	07/11/80	1720	1200		
017	P	08/11/80	0030	300		
018	P	08/11/80	1725	1200		
019	P	08/11/80	1833		1200	T,S.
020	P	08/11/80	2330	300		
021	P	09/11/80	1710	1200		
022	P	09/11/80	2225	300		
023	P	10/11/80	1712	1200		
024	P	10/11/80	2255	300		
025	P	11/11/80	1707	1400		
026	P	11/11/80	1805		1000	T,S.
027	P	11/11/80	2245	300		
028	P	12/11/80	1750	1200		
029	P	13/11/80	0010	300		
030	P	13/11/80	1705	1200		
031	P	14/11/80	0000	300		
032	P	14/11/80	1712	1200		
033	P	15/11/80	0000	300		
034	P	15/11/80	1705	1300		
035	P	15/11/80	1808		250	T,S,O_2, Chl <u>a</u>
036	P	15/11/80	2120	300		
037	P	16/11/80	1705	1200		
038	P	16/11/80	1817		1200	T,S,O_2
039	P	17/11/80	0003	300		
040	P	17/11/80	1755	900		
041	P	18/11/80	0005	300		
042	P	18/11/80	1705	1200		
043	P	18/11/80	2123	300		
044	P	19/11/80	1359	300		
045	E3	19/11/80	1515	300		
046	C1	19/11/80	1635	300		MILE
047	E4	19/11/80	1745	300		grid
048	E101	19/11/80	1908	300		
049	S8	20/11/80	0010	300		
050	S7	20/11/80	0140	300		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
051	W101	20/11/80	0300	300		
052	W4	20/11/80	0417	300		MILE
053	W3	21/11/80	0525	300		grid
054	P	21/11/80	1715	1200		
055	P	21/11/80	2308	300		
056	P	22/11/80	1707	1200		
057	P	22/11/80	2135	300		
058	P	23/11/80	1930	1200		
059	P	23/11/80	1704	1200		
060	P	24/11/80	2225	300		
061	P	24/11/80	1745	1200		
062	Off Stn.	25/11/80	1725	1200		50°22N 143°37W
063	Off Stn.	25/11/80	1850		1200	T,S,0_2
064	P	26/11/80	2312	300		
065	P	26/11/80	0208	320		
066	P	27/11/80	1700	1200		
067	P	27/11/80	1922		1200	T,S.0_2
068	P	28/11/80	2230	300		
069	P	28/12/80	1710	1200		
070	P	29/12/80	2142	240		
071	P	29/12/80	1710	1200		
072	P	29/12/80	2230	300		
073	P	30/12/80	1735	1200		
074	P	30/12/80	0000	300		
075	P	31/12/80	1705	1200		
076	P	31/12/80	2145		4200	T,S
077	P	01/12/80	2300	300		
078	Off Stn.	01/12/80	2230	300		50°05N 142°19.5W
079	P	01/12/80	1717	1200		
080	P	01/12/80	1848		1200	T,S,0_2
081	P	01/12/80	2317	300		
082	P	02/12/80	1400	1200		
083	W3	02/12/80	1551	300		
084	C1	02/12/80	1752	300		MILE
085	W4	02/12/80	1918	300		grid
086	W101	03/12/80	2115	300		
087	S7	03/12/80	2255	300		
088	S8	04/12/80	0046	300		
089	E101	04/12/80	0215	300		
090	E4	04/12/80	0340	300		
091	E3	05/12/80	0517	300		
092	P	05/12/80	2325	1200		
093	12	06/12/80	2045	1200		
094	8	06/12/80	2202	300		
095	7	07/12/80	0411	1200		
096	6	07/12/80	1037	1200		
097	5	08/12/80	1657	1200		
098	4	08/12/80	2042	1200		LINE P
099	3	09/12/80	0055	1100		
100	2	09/12/80	0408	100		
101	1	10/12/80	0640	120		
102	1	10/12/80	0654		125	T,S

PROGRAM OF OBSERVATION FROM CCGS QUADRA, 12 December 1980 - 22 January 1981(P-80-9) (MEDS Ref. No. 15-80-009)

En route to Station P (Line P)

STD profiles were taken at Line P station 1 to 7 and 10. At stations 6 and 10 a hydrocast was also made for temperature and salinity.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 5-1/2, 6-1/2, 7-1/2, 8-1/2, 9, 9-1/2, 10-1/2, 11 and 12.

On Station P

The oceanographic program was carried out as follows:

Physical Oceanography:

1) Two hydrocasts to 4200 metres for temperature, salinity and oxygen. Three hydrocasts to 1500 metres for temperature, salinity and oxygen.

2) Fifty one STD profiles were taken at Station P. Fiteen STD profiles were taken at MILE GRID positions.

3) Daily salinity samples were taken from the seawater loop at 0000 hours, GMT.

4) The regular 3-hourly BT observations were deleted during this cruise. The temperature profiles only of all STD's taken at Station P were digitized and transmitted according to the IGOSS format.

Marine Geochemistry

Samples for air CO_2, PCO_2, POC, alkalinity, nutrients and tritium obtained during this cruise are for the Ocean Chemistry Division and are not included in this data report.

Biological Oceanography

Samples from 150 metre vertical plankton hauls (Station P) and nutrients (Line P) obtained during this cruise are for the Pacific Biological Station and are not included in this data report.

En Route from Station P (Line P)

STD profiles were taken at Line P stations 12, 7, 6, 3, 2 and 1.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at all BT positions 1, 2, 3, 4, 5, 5-1/2, 6, 6-1/2, 8-1/2, 9-1/2, 10-1/2 and 12-1/2.

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
001	1	13/12/80	0004	100		
002	2	13/12/80	0129	90		
003	3	13/12/80	0338	1200		
004	4	13/12/80	0642	1200		
005	5	13/12/80	1003	1200		
006	6	13/12/80	1643	1200		LINE P
007	6	13/12/80	1755		1000	T,S
008	7	14/12/80	0009	1200		
009	10	14/12/80	1758	1200		
010	10	14/12/80	1909		1200	T,S
011	P	16/12/80	1718	300		
012	E3	16/12/80	1833	300		
013	E4	16/12/80	2001	300		
014	C1	16/12/80	2133	300		MILE
015	W4	16/12/80	2331	300		grid
016	W3	17/12/80	0114	300		
017	P	17/12/80	0301	300		
018	P	17/12/80	1749	300		
019	P	18/12/80	1722	1200		
020	P	18/12/80	2336	1200		
021	P	19/12/80	0050		1500	T,S,O_2
022	P	19/12/80	1717	1200		
023	P	19/12/80	2312	1200		
024	P	21/12/80	1753	1200		
025	P	21/12/80	2315	1200		
026	P	22/12/80	1720	1200		
027	P	23/12/80	1721	300		
028	P	23/12/80	2314	1200		
029	P	24/12/80	1714	1200		
030	P	24/12/80	2317	1250		
031	P	25/12/80	0023		4200	T,S,O_2
032	P	25/12/80	1716	1200		
033	P	26/12/80	1715	1200		
034	P	26/12/80	2313	1200		
035	P	27/12/80	1720	1200		
036	P	27/12/80	2317	1210		
037	P	28/12/80	1712	1200		
038	P	28/12/80	2313	1200		
039	P	29/12/80	1715	1200		
040	E3	29/12/80	1908	300		
041	E4	29/12/80	2035	300		MILE
042	C1	29/12/80	2209	300		grid
043	W4	29/12/80	2334	1200		
044	W3	30/12/80	0110	300		
045	P	30/12/80	0227	300		
046	P	30/12/80	1719	300		
047	P	31/12/80	1833	1200		
048	P	01/01/81	0010	1200		
049	P	01/01/81	1716	1200		
050	P	01/01/81	1824		4200	T,S,02

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
051	P	01/01/81	2314	1200		
052	P	02/01/81	1720	1200		
053	P	02/01/81	2314	1160		
054	P	04/01/81	1717	1200		
055	P	05/01/81	1723	1200		
056	P	05/01/81	2312	1200		
057	P	07/01/81	1724	1210		
058	P	07/01/81	2320	1200		
059	P	08/01/81	1715	420		
060	E3	08/01/81	1914	300		
061	E4	08/01/81	2033	300		
062	C1	08/01/81	2147	300		MILE
063	W4	09/01/81	0044	620		grid
064	W3	09/01/81	0216	300		
065	P	09/01/81	0325	300		
066	P	09/01/81	1722	1200		
067	P	09/01/81	1833		1500	T,S.O_2
068	P	09/01/81	2326	1200		
069	P	10/01/81	1727	1200		
070	P	10/01/81	2316	1210		
071	P	11/01/81	1718	1200		
072	P	11/01/81	2312	1200		
073	P	13/01/81	1718	1200		
074	P	13/01/81	2312	1200		
075	P	15/01/81	1714	1200		
076	P	15/01/81	1837		1500	T,S,O_2
077	P	15/01/81	2318	1200		
078	P	16/01/81	2317	1200		
079	P	17/01/81	1720	1200		
080	P	17/01/81	2314	1200		
081	12	18/01/81	1737	1200		
082	12	18/01/81	1853	1200		
083	11	19/01/81	0337	1110		
084	10	19/01/81	0920	1200		LINE P
085	9	19/01/81	1548	1200		
086	8	19/01/81	2151	1200		
087	7	20/01/81	0430	1200		

PROGRAM OF OBSERVATION FROM CCGS VANCOUVER, 16 January - 26 February 1981 (P-81-1) (MEDS Ref. No. 15-81-001).

En route to Station P (Line P)

STD profiles were taken at Line P station 1, 2, 3, 4, 7, 8, 9, 10, 11 and 12.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 5, 5-1/2, 6, 9-1/2, 10-1/2, 11-1/2, and 12-1/2.

On Station P

The oceanographic program was carried out as follows:

Physical Oceanography:

1) Five hydrocasts to 1200 metres for temperature, salinity and oxygen.

2) Sixty one STD profiles were taken at Station P.
Twelve STD profiles were taken at MILE GRID positions.

3) Daily salinity samples were taken from the seawater loop at 0000 hours, GMT.

4) The regular 3-hourly BT observations were deleted during this cruise. The temperature profiles only of all STD's taken at Station P were digitized and transmitted according to the IGOSS format.

Marine Geochemistry

Samples for air CO_2, PCO_2, POC, alkalinity, nutrients and tritium obtained during this cruise are for the Ocean Chemistry Division and are not included in this data report.

Biological Oceanography

Samples from 150 metre vertical plankton hauls (Station P) and nutrients (Line P) obtained during this cruise are for the Pacific Biological Station and are not included in this data report.

En Route from Station P (Line P)

STD profiles were taken at Line P stations 12-1/2, 5, 3, 2 and 1.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 4, 5-1/2 and 7.

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
001	1	16/01/81	2319	120		
002	2	17/01/81	0047	105		
003	3	17/01/81	0247	1200		
004	4	17/01/81	0558	1200		LINE P
005	7	17/01/81	2017	1200		
006	8	18/01/81	0227	1200		
007	9	18/01/81	0843	1200		
008	10	18/01/81	1549	1200		
009	11	18/01/81	2230	1200		
010	12	19/01/81	0618	1200		
011	P	19/01/81	1708	1200		
012	P	19/01/81	2311	300		
013	P	19/01/81	2356		1200	
014	P	23/01/81	1709	1200		
015	P	23/01/81	2308	300		
016	P	24/01/81	2309	300		
017	P	25/01/81	1814	1200		
018	P	25/01/81	2036	300		
019	P	25/01/81	2246	300		
020	P	26/01/81	0121	300		
021	W4	26/01/81	0337	300		MILE
022	W3	26/01/81	0507	300		grid
023	P	26/01/81	1707	1200		
024	P	26/01/81	2153		1200	
025	P	26/01/81	2225	300		
026	P	27/01/81	1715	1200		
027	P	27/01/81	2241	300		
028	P	28/01/81	1826	1200		
029	P	28/01/81	2215	300		
030	P	29/01/81	1813	1200		
031	P	29/01/81	2310	300		
032	P	30/01/81	1920	1200		
033	P	30/01/81	2315	300		
034	P	31/01/81	1807	1200		
035	P	01/02/81	0105	300		
036	P	01/02/81	1708	1200		
037	P	02/02/81	1710	1200		
038	P	02/02/81	1831		1200	
039	P	03/02/81	0015	300		
040	P	03/02/81	1540	1200		
041	E3	03/02/81	1855	300		
042	E4	03/02/81	2155	300		MILE
043	C1	04/02/81	0020	300		grid
044	W4	04/02/81	0155	300		
045	W3	04/02/81	0403	300		
046	P	04/02/81	1726	1200		
047	P	04/02/81	2320	300		
048	P	05/02/81	1901	1200		
049	P	05/02/81	2330	300		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
050	P	06/02/81	1735	1200		
051	P	06/02/81	2312	300		
052	P	07/02/81	1730	1200		
053	P	07/02/81	2005	300		
054	P	08/02/81	1703	1200		
055	P	08/02/81	2313	300		
056	P	09/02/81	1715	1200		
057	P	09/02/81	2315	300		
058	P	10/02/81	1630		1200	
059	P	10/02/81	1645	1200		
060	P	11/02/81	0023	300		
061	P	11/02/81	1710	1200		
062	P	11/02/81	2310	300		
063	P	12/02/81	1705	1200		
064	P	12/02/81	2310	300		
065	P	13/02/81	1400	1200		MILE grid
066	E3	13/02/81	1625	300		
067	E4	13/02/81	1850	300		
068	C1	13/02/81	2045	300		
069	W4	13/02/81	2343	300		
070	W3	14/02/81	0110	300		
071	P	14/02/81	1712	1200		
072	P	14/02/81	2309	300		
073	P	15/02/81	1706	1200		
074	P	15/02/81	1800		1200	
075	P	15/02/81	2332	300		
076	P	16/02/81	1740	1200		
077	P	17/02/81	1723	1200		
078	P	17/02/81	2310	300		
079	P	18/02/81	1705	1200		
080	P	18/02/81	2314	300		
081	P	19/02/81	1708	1200		
082	P	21/02/81	1723	1200		
083	P	21/02/81	2314	300		LINE P
084	12-1/2	22/02/81	1719	1200		
085	5	25/02/81	0030	1200		
086	3	25/02/81	1712	1200		
087	2	25/02/81	0931	100		
088	1	25/02/81	1100	100		

PROGRAM OF OBSERVATION FROM CCGS QUADRA, 20 February - 2 April 1981 (P-81-2)(MEDS Ref. No. 15-81-002)

En route to Station P (Line P)

A STD profile was taken at Line P station 8.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 1 to 6, 7, 7-1/2, 8, 9-1/2, 11-1/2, 12 and 12-1/2.

On Station P

The oceanographic program was carried out as follows:

Physical Oceanography:

1) Two hydrocasts to 4200 metres for temperature, salinity and oxygen. Three hydrocasts to 1500 metres for temperature, salinity and oxygen.

2) Ninety three STD profiles were taken at Station P. Fifteen STD profiles were taken at MILE GRID positions.

3) Daily salinity samples were taken from the seawater loop at 0000 hours, GMT.

4) The regular 3-hourly BT observations were deleted during this cruise. The temperature profiles only of all STD's taken at Station P were digitized and transmitted according to the IGOSS format.

Marine Geochemistry

Samples for air CO_2, PCO_2, POC, alkalinity, nutrients and tritium obtained during this cruise are for the Ocean Chemistry Division and are not included in this data report.

Biological Oceanography

Samples from 150 metre vertical plankton hauls (Station P) and nutrients (Line P) obtained during this cruise are for the Pacific Biological Station and are not included in this data report.

En Route from Station P (Line P)

STD profiles were taken at Line P stations 12 and 8 to 1. At each of stations 5 and 3 a hydrocast was also made for temperature and salinity.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 5-1/2, 7-1/2, 8-1/2, 9-1/2, 10, 10-1/2, 11 and 11-1/2.

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
001	8	16/02/81	2236	300		LINE P
002	P	17/02/81	1723	1200		
003	P	17/02/81	2006		1500	
004	P	17/02/81	2314	310		
005	P	17/02/81	1721	1390		
006	E3	18/02/81	1915	310		
007	E4	18/02/81	2035	310		MILE
008	C1	18/02/81	2150	320		grid
009	W4	18/02/81	2330	310		
010	W3	19/02/81	0040	310		
011	P	19/02/81	0204	330		
012	P	19/02/81	1719	1360		
013	P	19/02/81	2327	1370		
014	P	23/02/81	1725	1380		
015	P	23/02/81	2310	1400		
016	P	24/02/81	1720	1380		
017	P	25/02/81	2338	300		
018	P	25/03/81	1712	1380		
019	P	25/03/81	2333	1400		
020	P	26/03/81	1724	1370		
021	P	26/03/81	2105		4200	
022	P	26/03/81	2343	1380		
023	P	26/03/81	1716	1370		
024	P	26/03/81	0049	1200		
025	P	26/03/81	1757	310		
026	P	27/03/81	1850	300		
027	P	27/03/81	1949	300		
028	P	28/03/81	2050	300		
029	P	28/03/81	2149	300		
030	P	29/03/81	2235	300		
031	P	29/03/81	0047	300		
032	P	30/03/81	0147	300		
033	P	30/03/81	0254	300		
034	P	31/03/81	1725	1340		
035	P	01/03/81	2320	1380		
036	P	01/03/81	1714	1390		
037	P	02/03/81	2137	300		
038	P	02/03/81	2229	300		
039	P	03/03/81	2329	300		
040	P	03/03/81	0030	300		
041	P	03/03/81	0138	300		
042	P	03/03/81	0231	300		
043	P	04/03/81	0328	300		
044	P	04/03/81	0419	300		
045	P	04/03/81	1717	1380		
046	P	04/03/81	1933	300		
047	P	04/03/81	2150	320		
048	P	05/03/81	2330	300		
049	P	05/03/81	0135	300		
050	P	09/03/81	0332	310		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
051	P	09/03/81	0421	300		
052	P	09/03/81	1719	1330		
053	P	10/03/81	1930	300		
054	P	10/03/81	2142	300		
055	P	10/03/81	2330	300		
056	P	11/03/81	1714	1280		
057	E3	11/03/81	1901	310		
058	E4	11/03/81	2036	300		MILE
059	C1	11/03/81	2158	300		grid
060	W4	11/03/81	2327	300		
061	W3	12/03/81	0052	310		
062	P	12/03/81	0203	310		
063	P	12/03/81	1743	1200		
064	P	12/03/81	1929	300		
065	P	12/03/81	2133	300		
066	P	12/03/81	2324	250		
067	P	13/03/81	1723	1400		
068	P	13/03/81	2316	1380		
069	P	14/03/81	1726	1400		
070	P	14/03/81	2318	1300		
071	P	15/03/81	0035		1500	
072	P	15/03/81	1718	1380		
073	P	15/03/81	2309	300		
074	P	16/03/81	2305	1320		
075	P	18/03/81	1723	1410		
076	P	18/03/81	2238		4200	
077	P	19/03/81	0015	1350		
078	P	19/03/81	1711	1370		
079	P	19/03/81	2313	1370		
080	P	20/03/81	1721	1390		
081	P	20/03/81	2310	1210		
082	P	21/03/81	1715	1380		
083	P	21/03/81	2305	1330		
084	P	22/03/81	1714	1400		
085	P	22/03/81	2311	1340		
086	P	23/03/81	1716	1400		
087	P	23/03/81	1845		1500	
088	P	23/03/81	1937	300		
089	P	23/03/81	2030	300		
090	P	23/03/81	2134	310		
091	P	23/03/81	2230	310		
092	P	23/03/81	2331	320		
093	P	24/03/81	0035	320		
094	P	24/03/81	0132	320		
095	P	24/03/81	0240	320		
096	P	24/03/81	0329	320		
097	P	24/03/81	0427	320		
098	P	24/03/81	1709	1400		
099	P	24/03/81	2310	320		
100	P	25/03/81	1721	1370		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
101	E3	25/03/81	1849	320		
102	E4	25/03/81	2005	320		
103	C1	25/03/81	2140	310		MILE
104	W4	25/03/81	2327	320		grid
105	W3	26/03/81	0046	320		
106	4	26/03/81	0205	320		
107	1	26/03/81	1721	1370		
108	4	26/03/81	2314	1350		
109	3	27/03/81	1715	1210		
110	P	27/03/81	2310	1360		
111	P	28/03/81	1727	1380		
112	P	28/03/81	2321	1370		
113	12	29/03/81	1712	1370		
114	8	30/03/81	1945	1360		
115	7	31/03/81	0158	600		
116	6	31/03/81	0813	1210		LINE P
117	5	31/03/81	1421	1210		
118	5	31/03/81	1517		1500	
119	4	31/03/81	1947	1210		
120	3	31/03/81	2318	1210		
121	3	01/04/81	0020		1000	
122	2	01/04/81	0245	95		
123	1	01/04/81	0423	95		

PROGRAM OF OBSERVATION FROM CCGS VANCOUVER, 27 March - 14 May 1981 (P-81-3)(MEDS Ref. No. 15-81-003).

En route to Station P (Line P)

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

On Station P

The oceanographic program was carried out as follows:

Physical Oceanography:

1) STD profiles were taken at Station P.
STD profiles were taken at MILE GRID positions.

3) Daily salinity samples were taken from the seawater loop at 0000 hours, GMT.

4) The regular 3-hourly BT observations were deleted during this cruise. The temperature profiles only of all STD's taken at Station P were digitized and transmitted according to the IGOSS format.

Marine Geochemistry

Samples for air CO , PCO , POC, alkalinity, nutrients and tritium obtained during this cruise are for the Ocean Chemistry Division and are not included in this data report.

Biological Oceanography

Samples from 150 metre vertical plankton hauls (Station P) and nutrients (Line P) obtained during this cruise are for the Pacific Biological Station and are not included in this data report.

En Route from Station P (Line P)

A STD profile was taken at Line P Station 12.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

A XBT was taken at BT position 5.

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
001	P	01/04/81	0130	300		
002	P	01/04/81	1745	1000		
003	P	01/04/81	2220	300		
004	P	02/04/81	1725	1200		
005	E3	02/04/81	1925	300		
006	E4	02/04/81	2125	300		
007	C1	02/04/81	2340	300		MILE
008	W4	03/04/81	0140	300		grid
009	W3	03/04/81	0330	300		
010	P	03/04/81	1730	1200		
011	P	03/04/81	2320	300		
012	P	04/04/81	1720	1200		
013	P	04/04/81	2335	300		
014	P	05/04/81	1720	1050		
015	P	05/04/81	2315	300		
016	P	06/04/81	1730	900		
017	P	06/04/81	2315	300		
018	P	07/04/81	1720	900		
019	P	07/04/81	2300	300		
020	P	08/04/81	1720	900		
021	P	08/04/81	2320	300		
022	P	09/04/81	1715	900		
023	P	09/04/81	2315	300		
024	P	10/04/81	1725	900		
025	P	10/04/81	2315	300		
026	P	11/04/81	1725	900		
027	P	11/04/81	2345	300		
028	P	12/04/81	1720	1000		
029	P	12/04/81	2320	300		
030	P	13/04/81	1720	700		
031	P	13/04/81	2330	300		
032	P	14/04/81	1830	900		
033	P	14/04/81	2315	300		
034	P	15/04/81	1715	900		
035	P	15/04/81	2307	300		
036	P	16/04/81	1740	900		
037	P	16/04/81	2315	300		
038	P	17/04/81	1725	800		
039	P	17/04/81	2315	300		
040	P	18/04/81	1712	800		
041	P	18/04/81	2314	300		
042	P	19/04/81	2325	300		
043	P	20/04/81	1730	900		
044	P	20/04/81	1745	300		
045	E3	20/04/81	1940	300		
046	E4	20/04/81	2200	300		MILE
047	C1	21/04/81	0015	300		grid
048	W4	21/04/81	0300	300		
049	W3	21/04/81	0450	300		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
050	P	21/04/81	1723	900		
051	P	21/04/81	2312	300		
052	P	22/04/81	1720	900		
053	P	22/04/81	2325	300		
054	P	23/04/81	1720	900		
055	P	23/04/81	2315	300		
056	P	24/04/81	1717	1000		
057	P	24/04/81	2332	300		
058	P	25/04/81	1720	900		
059	P	25/04/81	2315	300		
060	P	26/04/81	1730	1000		
061	P	26/04/81	2315	300		
062	P	27/04/81	1712	1000		
063	P	27/04/81	2307	300		
064	P	28/04/81	1735	900		
065	P	28/04/81	2315	300		
066	P	29/04/81	1720	900		
067	P	01/05/81	1720	900		
068	P	01/05/81	2305	300		
069	P	02/05/81	1720	900		
070	P	02/05/81	2320	300		
071	P	03/05/81	1715	900		
072	P	03/05/81	2312	300		
073	P	04/05/81	1715	900		
074	E3	04/05/81	1930	300		
075	E4	04/05/81	2122	300		MILE
076	C1	04/05/81	2310	300		grid
077	W4	05/05/81	0050	300		
078	W3	05/05/81	0240	300		
079	P	05/05/81	1715	900		
080	P	05/05/81	2315	300		
081	P	06/05/81	1715	900		
082	P	06/05/81	2315	300		
083	P	07/05/81	1737	850		
084	P	07/05/81	2320	300		
085	P	08/05/81	1717	850		
086	P	09/05/81	0005	300		
087	P	09/05/81	1710	1000		
088	P	09/05/81	2310	300		
089	P	10/05/81	1717	900		
090	P	10/05/81	2300	300		
091	12	11/05/81	1715	900		
092		11/05/81	2317	300		

PROGRAM OF OBSERVATION FROM CCGS QUADRA, 8 May - 25 June 1981 (P-81-4)
(MEDS Ref. No. 15-81-004)

En route to Station P (Line P)

STD profiles were taken at Line P stations.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 1 to 5, 7, 8, 8-1/2, 9, 10, 11 and 11-1/2.

On Station P

The oceanographic program was carried out as follows:

Physical Oceanography:

1) Two hydrocasts to 4200 metres for temperature, salinity and oxygen. Three hydrocasts to 1500 metres for temperature, slainity and oxygen.

2) Ninety three STD profiles were taken at Station P. Fifteen STD profiles were taken at MILE GRID positions.

3) Daily salinity samples were taken from the seawater loop at 0000 hours, GMT.

4) The regular 3-hourly BT observations were deleted during this cruise. The temperature profiles only of all STD's taken at Station P were digitized and transmitted according to the IGOSS format.

Marine Geochemistry

Samples for air CO_2, PCO_2, POC, alkalinity, nutrients and tritium obtained during this cruise are for the Ocean Chemistry Division and are not included in this data report.

Biological Oceanography

Samples from 150 metre vertical plankton hauls (Station P) and nutrients (Line P) obtained during this cruise are for the Pacific Biological Station and are not included in this data report.

En Route from Station P (Line P)

STD profiles were taken at Line P stations 12. 11, 9, 8 and 5. At each of stations 12 and 5 a hydrocast was also made for temperature and salinity.

Surface salinity and nutrient samples were taken from the seawater loop or bucket.

The surface temperature recorder (engine intake) and thermosalinograph (seawater loop) were run continuously.

XBT's were taken at BT positions 1 to 6, 7, 7-1/2, 8-1/2, 9-1/2, 10 and 11-1/2.

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
001	12	12/05/81	2348	1200		Line P
002	P	13/05/81	0808	1200		
003	P	13/05/81	2318	1200		
004	P	14/05/81	1549	1200		
+ 005	E3	14/05/81	1716	300		
006	E4	14/05/81	2015	300		
007	C1	14/05/81	2208	300		MILE
008	W4	14/05/81	2346	1200		grid
009	W3	15/05/81	0146	300		
010	P	15/05/81	1722	300		
011	P	15/05/81	2311	300		
012	P	16/05/81	1546	1200		
013	P	16/05/81	1753		4200	
014	P	16/05/81	2314	1200		
015	P	17/05/81	1722	1200		
016	P	17/05/81	2315	1200		
017	P	18/05/81	1545	1200		
018	P	19/05/81	0315	1200		
019	P	19/05/81	1721	1200		
020	P	19/05/81	2316	1200		
021	P	20/05/81	1717	1200		
022	P	20/05/81	2312	1200		
023	P	21/05/81	1714	1200		
024	P	21/05/81	1855		1500	
025	P	21/05/81	2316	1200		
026	P	22/05/81	1718	300		
027	P	23/05/81	1723	1200		
028	P	23/05/81	2314	1200		
029	P	24/05/81	1720	1200		
030	P	24/05/81	2316	1200		
031	P	25/05/81	1714	1200		
032	P	25/05/81	2315	1200		
033	P	26/05/81	1709	1200		
034	P	26/05/81	1825		4200	
035	P	26/05/81	2316	1200		
036	P	27/05/81	1718	1200		
037	P	27/05/81	2318	1200		
038	P	28/05/81	1728	1200		
039	P	28/05/81	2323	1200		
040	P	29/05/81	1711	1200		
041	P	29/05/81	2315	1200		
042	P	30/05/81	1721	1200		
043	E3	30/05/81	2009	300		
044	E4	30/05/81	2315	1200		MILE
045	C1	31/05/81	0125	300		grid
046	W4	31/05/81	0428	300		
047	W3	31/05/81	0553	300		
048	P	31/05/81	1721	1200		
049	P	31/05/81	2330	1200		
050	P	01/06/81	1716	1200		

LOG OF HYDROGRAPHIC AND STD OBSERVATIONS (continued)

Consec #	Stations	Date (Z)	Time (Z)	STD (m)	Hydrocast (m)	Comments
051	P	01/06/81	2319	1200		
052	P	02/06/81	1825	1200		
053	P	02/06/81	2316	1200		
054	P	03/06/81	1718	1200		
055	P	03/06/81	1850		1500	
056	P	03/06/81	2316	1200		
057	P	04/06/81	1724	1200		
058	P	04/06/81	2335	1200		
059	P	05/06/81	1712	1200		
060	P	05/06/81	2314	1200		
061	P	06/06/81	1717	1200		
062	P	06/06/81	2309	1200		
063	P	07/06/81	1711	1200		
064	P	07/06/81	2315	1200		
065	P	08/06/81	1715	1200		
066	P	08/06/81	2314	1200		
067	P	09/06/81	1714	1200		
068	P	09/06/81	1855		1500	
069	P	09/06/81	2313	1200		
070	P	10/06/81	1712	1200		
071	P	10/06/81	2323	1200		
072	P	11/06/81	1713	1200		
073	P	11/06/81	2315	1200		
074	P	12/06/81	1739		300	
075	P	13/06/81	1714	300		
076	P	15/06/81	1714	300		
077	P	16/06/81	0518	300		
078	P	16/06/81	1713	1200		
079	E3	16/06/81	1921	300		
080	E4	16/06/81	2048	300		MILE
081	C1	16/06/81	2234	300		grid
082	W4	17/06/81	0014	1200		
083	W4	17/06/81	0257		1500	
084	W3	17/06/81	0404	300		
085	P	17/06/81	1722	300		
086	P	18/06/81	0046	300		
087	P	18/06/81	1714	1200		
088	P	18/06/81	1846		1500	
089	P	18/06/81	2314	1200		
090	P	19/06/81	1714	1200		
091	P	20/06/81	0040	1200		
092	P	20/06/81	1721	1200		
093	P	20/06/81	2355	1200		
094	12	21/06/81	2002		1200	
095	12	21/06/81	2133	1200		
096	11	22/06/81	0520	1200		Line P
097	9	22/06/81	1738	1200		
098	8	23/06/81	0005	1200		
099	5	23/06/81	1936		1200	

* not digitized.

\+ salinity data not available.

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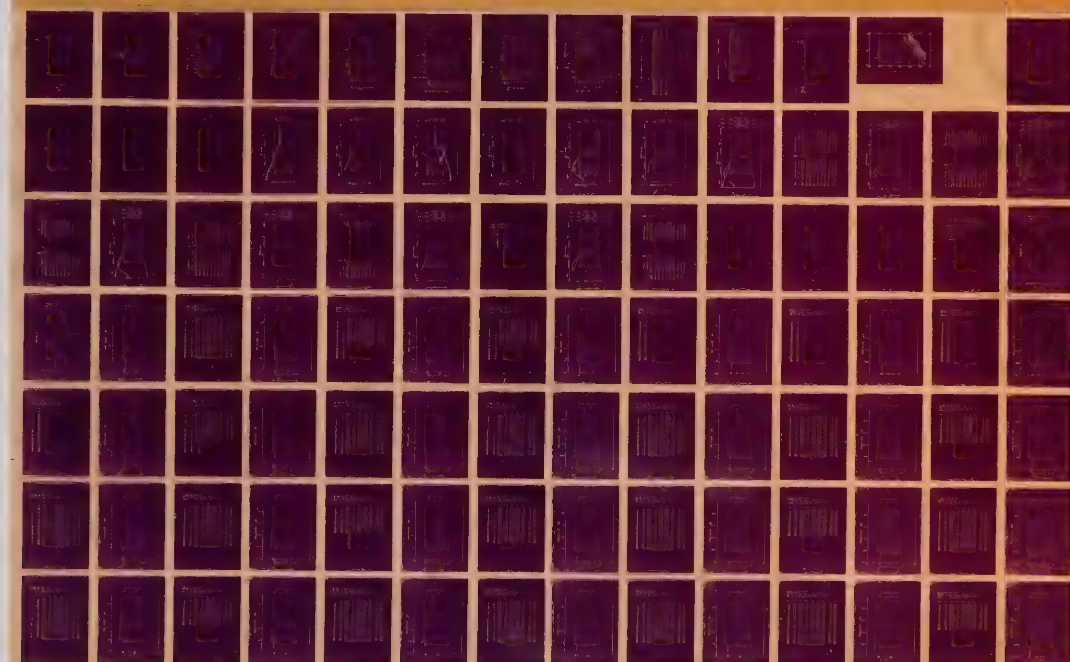
PMSR 81-24 (PT. 2) VOL. 106
OCEANOGRAPHIC OBSERVATIONS AT OCEAN
STATION P, 11 JAN-28 FEB 1980

1 OF 3



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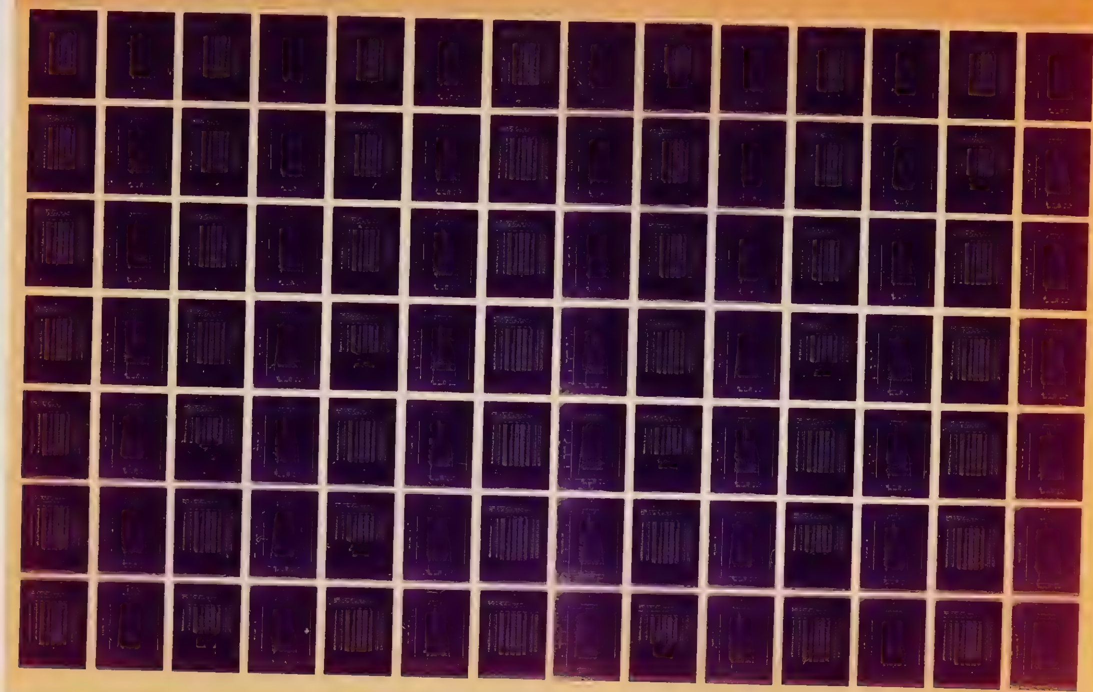
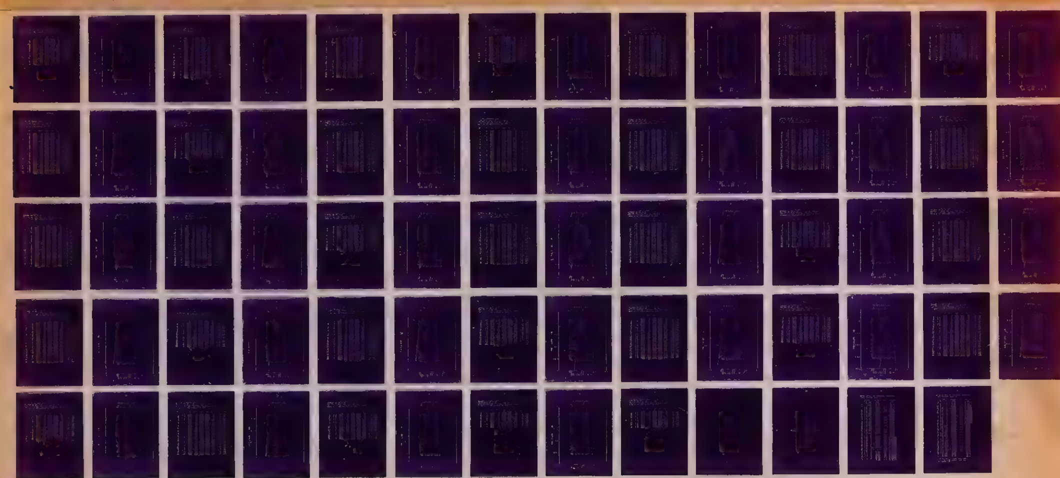
STATION P, 11 JAN-28 FEB 1980



PMSR 81-24 (PT. 2) VOL. 106
OCEANOGRAPHIC OBSERVATIONS AT OCEAN
STATION P, 11 JAN-28 FEB 1980

3 OF 3



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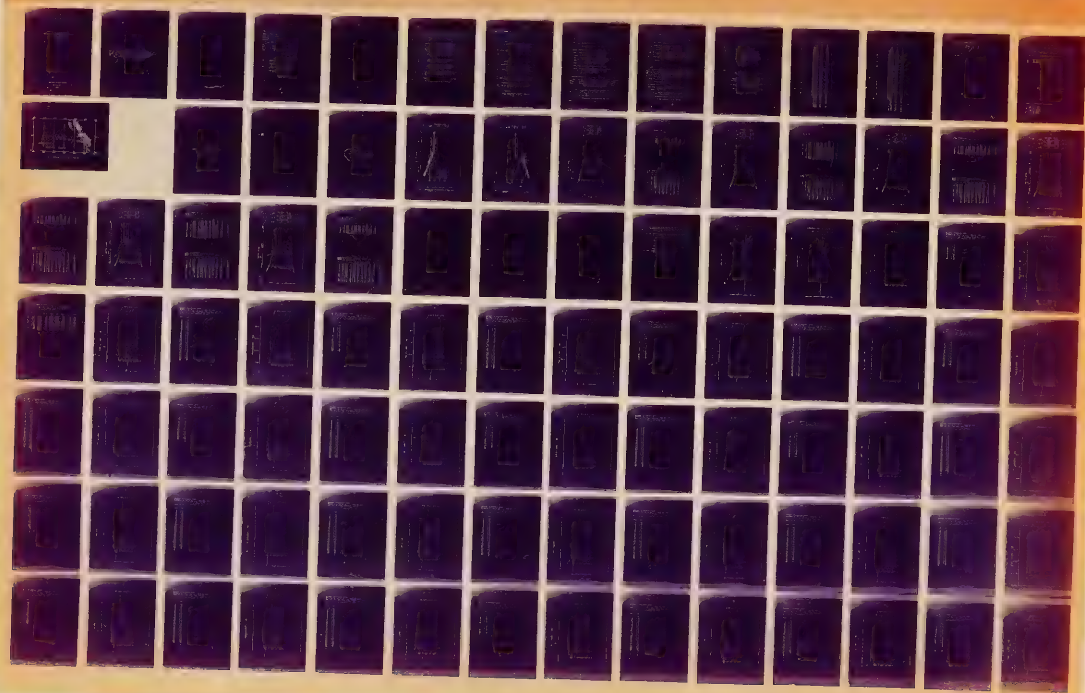
OCEANOGRAPHIC OBSERVATIONS AT OCEAN
STATION P, 22 FEB-10 APR. 1980.

1 OF 4



PMSR 81-24 (PT. 3) VOL. 107

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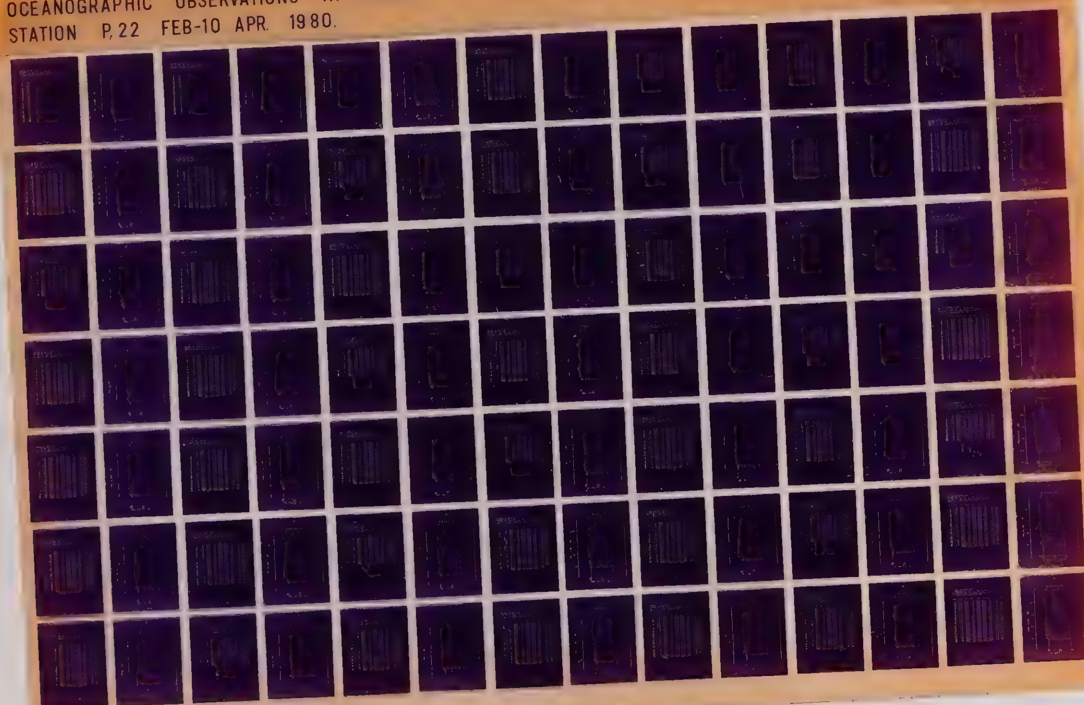

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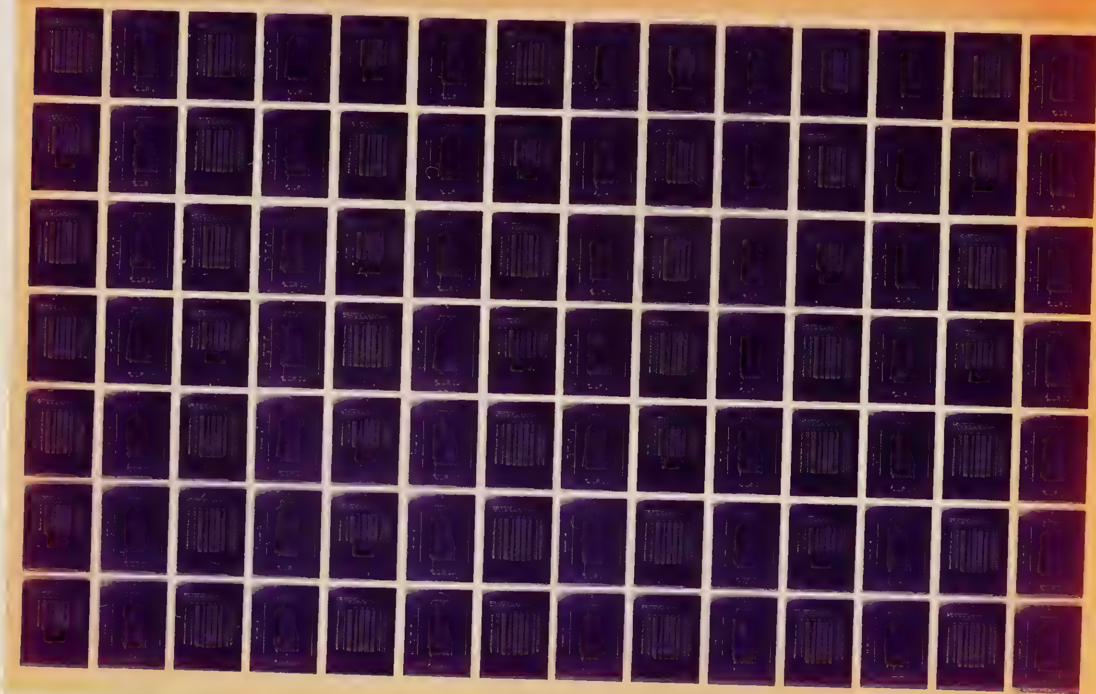

PMSR 81-24 (PT. 3) VOL. 107

OCEANOGRAPHIC OBSERVATIONS AT OCEAN STATION P, 22 FEB-10 APR. 1980.

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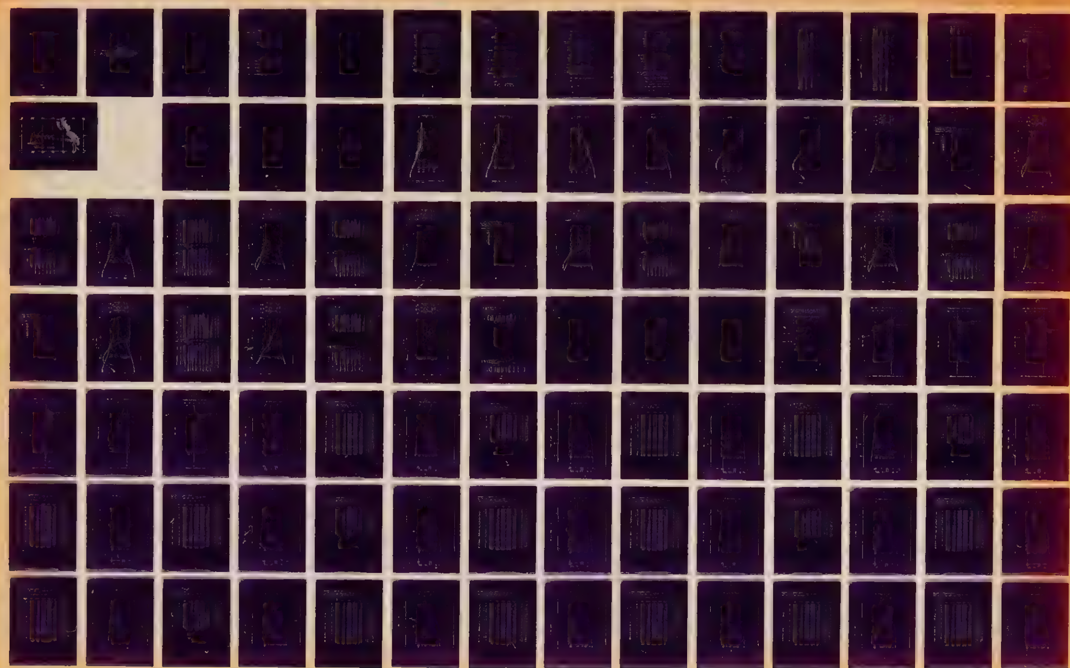
OCEANOGRAPHIC OBSERVATIONS AT OCEAN
STATION P,4 APR-22 MAY, 1980.

1 OF 4



PMSR 81-24 (PT.4) VOL.108
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STATION P,4 APR-22 MAY, 1980.

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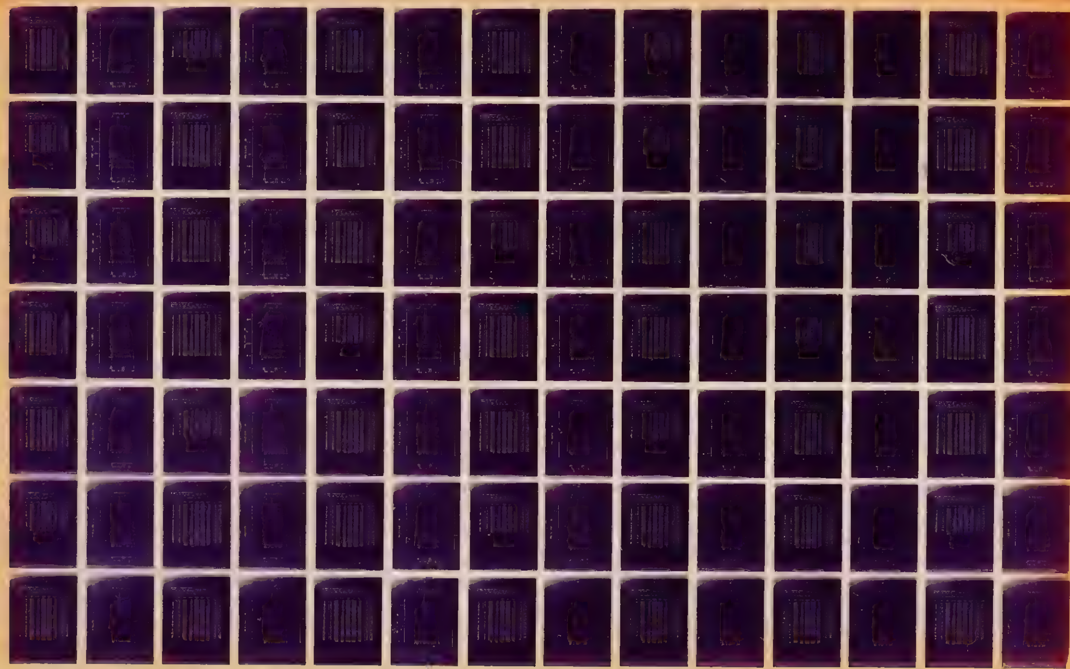
OCEANOGRAPHIC OBSERVATIONS AT OCEAN
STATION P,4 APR-22 MAY, 1980.

3 OF 4

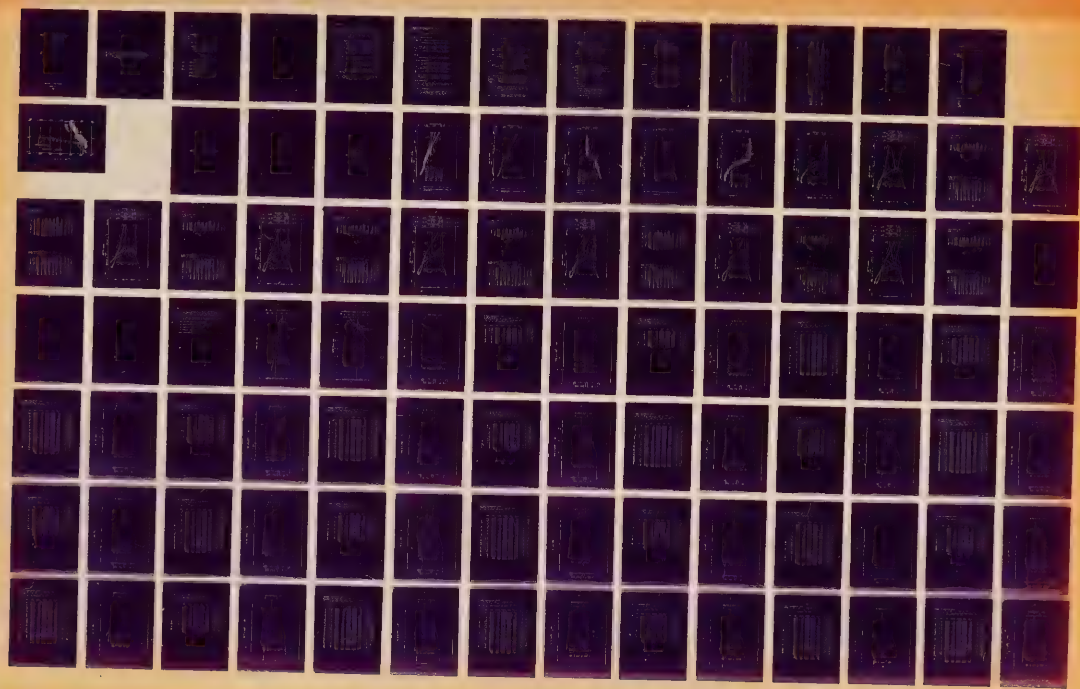


PMSR 81-24 (PT.4) VOL.108

OCEANOGRAPHIC OBSERVATIONS AT OCEAN

STATION P,4 APR-22 MAY, 1980.

PMSR 81-24 (PT. 5) VOL. 109
OCEANOGRAPHIC OBSERVATIONS AT OCEAN
STATION P,16 MAY-3 JUL 1980



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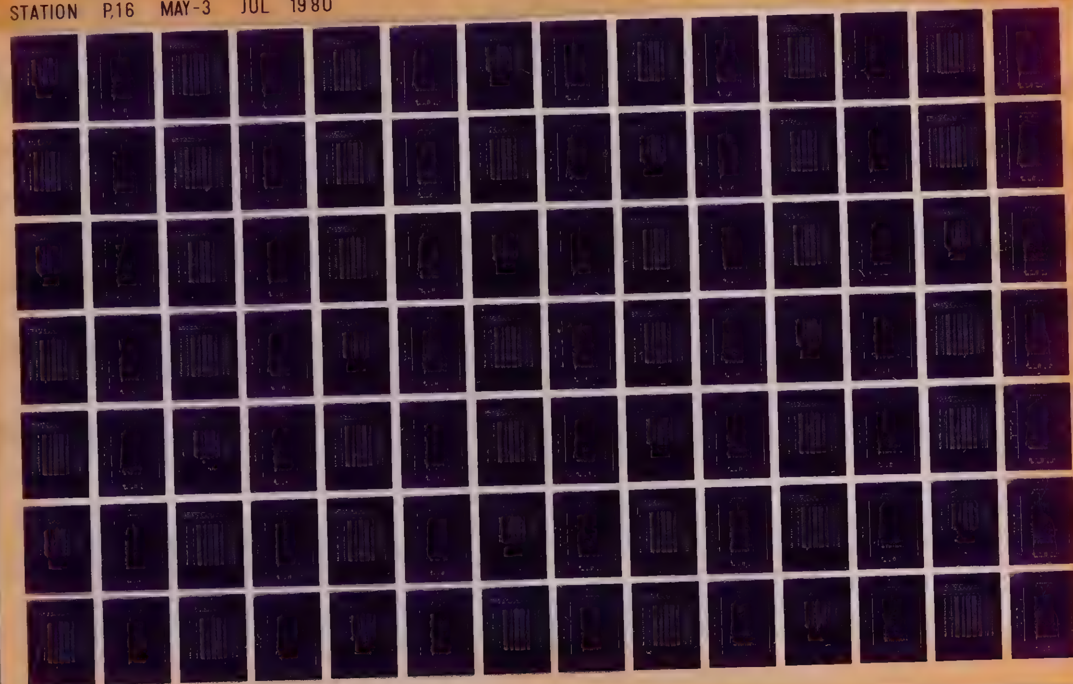

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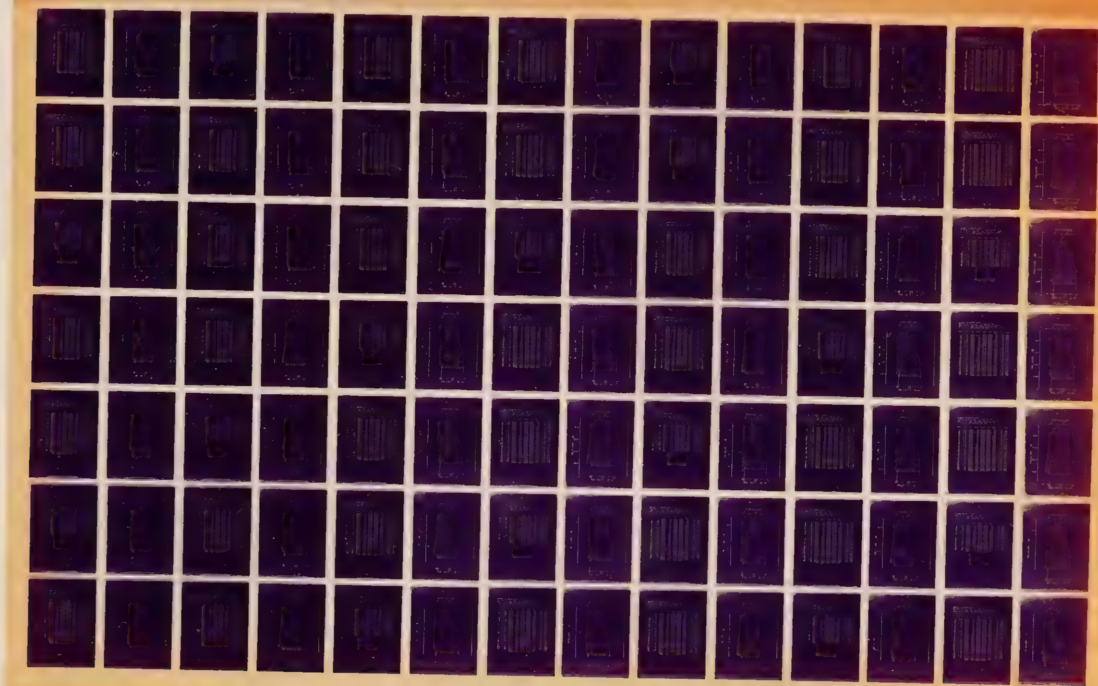
OCEANOGRAPHIC OBSERVATIONS AT OCEAN
STATION P,16 MAY-3 JUL 1980

3 OF 4



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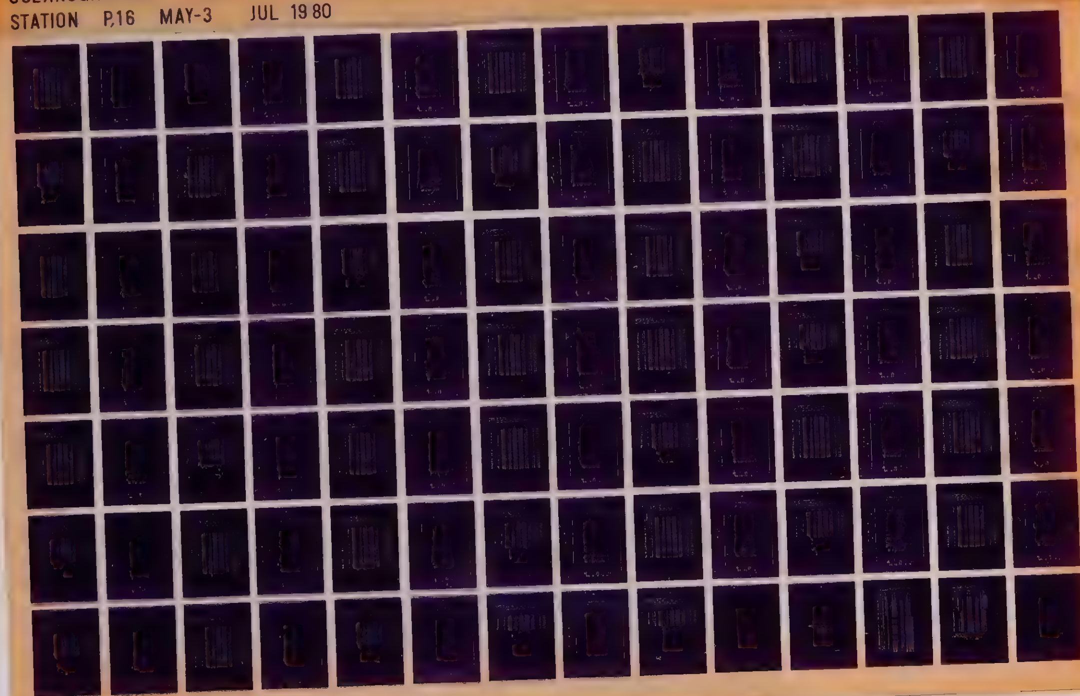

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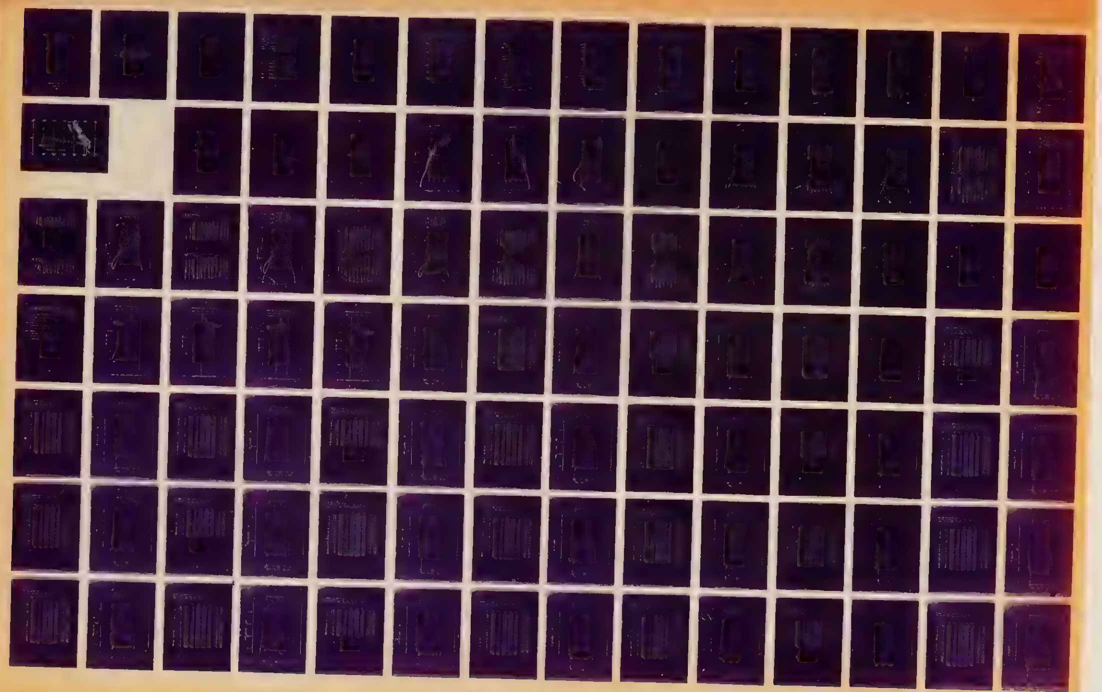
STATION P, 27 JUNE-14 AUG. 1980.



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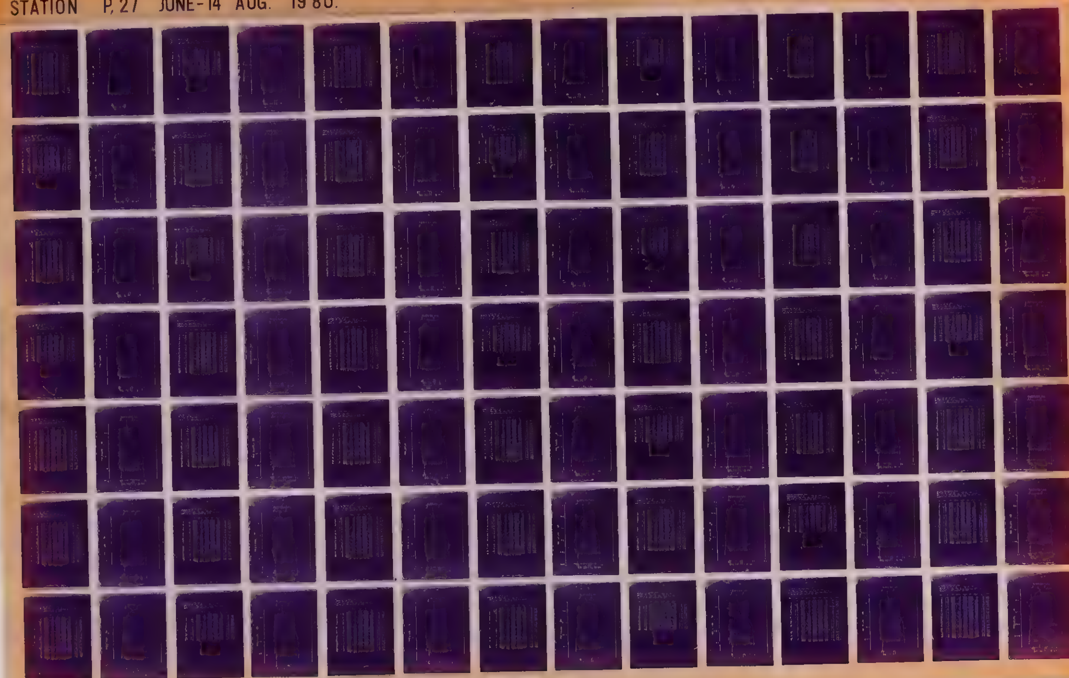

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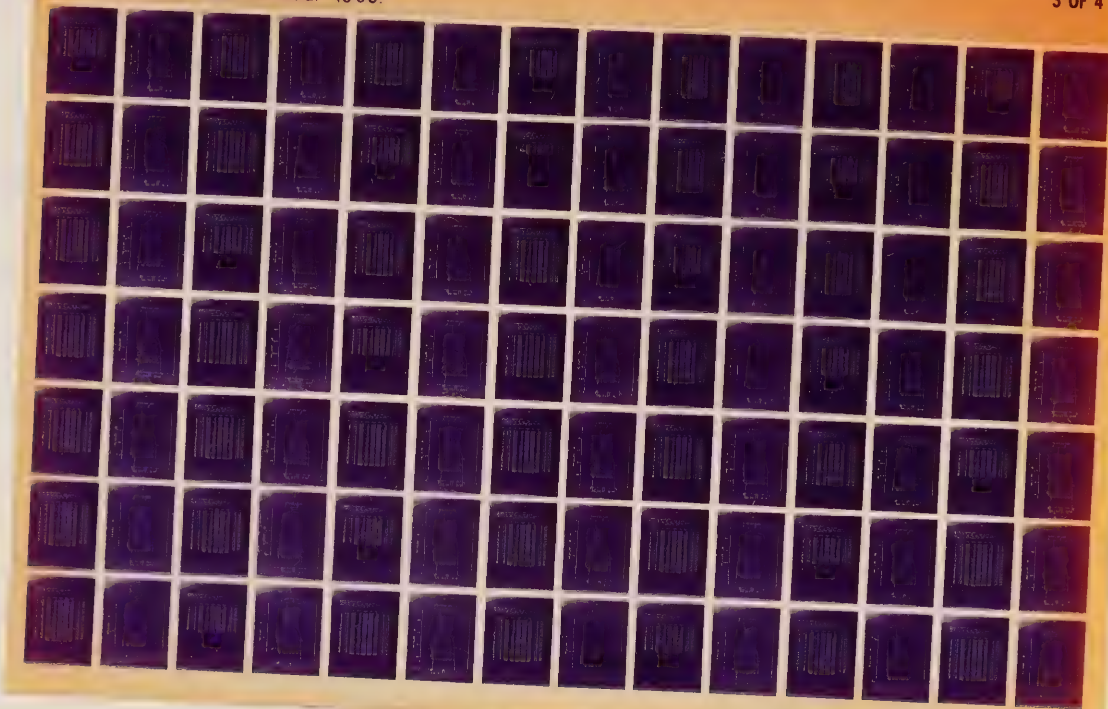
OCEANOGRAPHIC OBSERVATIONS AT OCEAN
STATION P, 27 JUNE-14 AUG. 1980.

3 OF 4

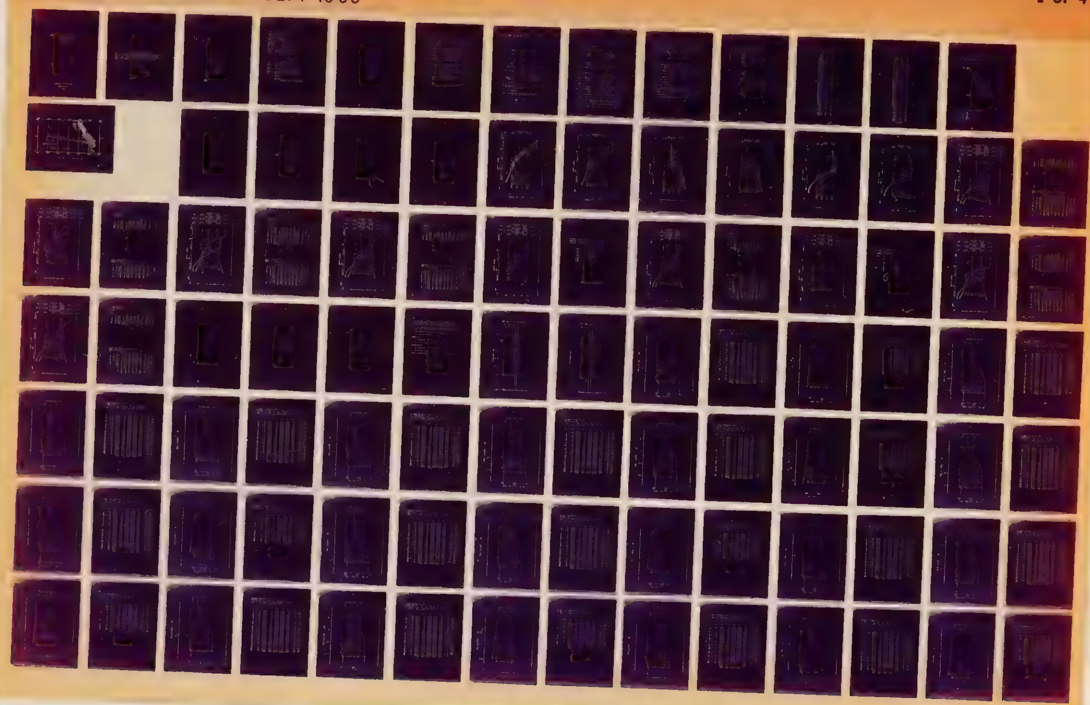


PMSR 81-24 (PT.6) VOL.110

OCEANOGRAPHIC OBSERVATIONS AT OCEAN STATION P, 27 JUNE-14 AUG. 1980.

4 OF 4

PMSR 81-24 (PT. 7) VOL 111
OCEANOGRAPHIC OBSERVATIONS AT OCEAN
STATION P. 8 AUG-23 SEPT 1980



PMSR 81-24 (PT. 7) VOL 111
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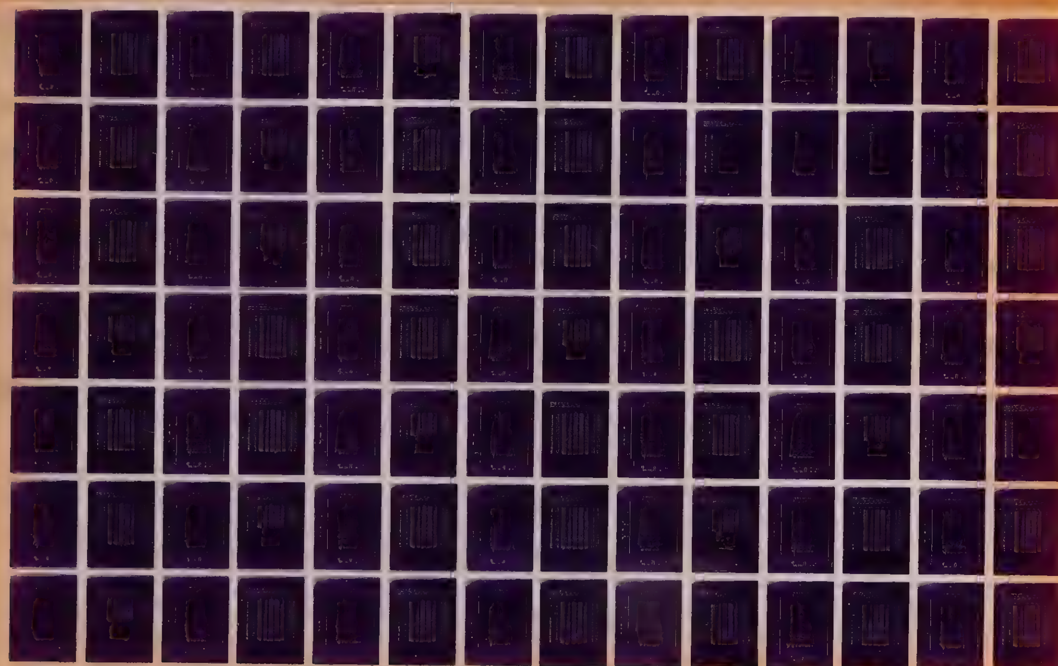
STATION P, 8 AUG-23 SEPT 1980



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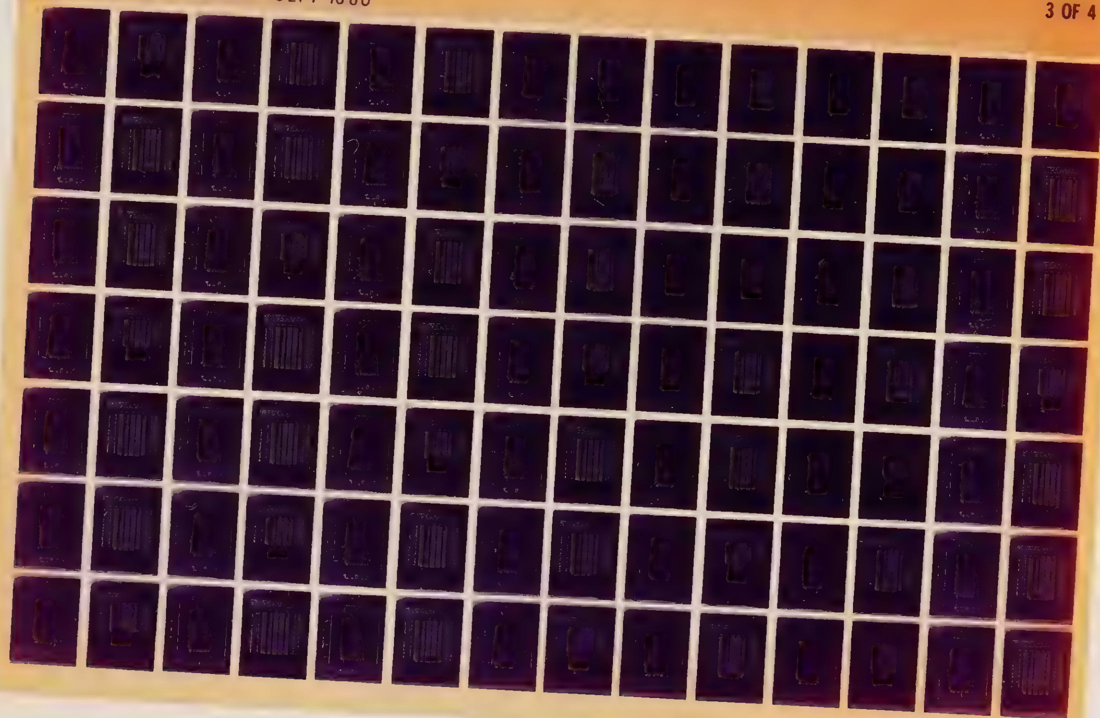
OCEANOGRAPHIC OBSERVATIONS AT OCEAN
STATION P. 8 AUG-23 SEPT 1980

3 OF 4



PMSR 81-24 (PT. 7) VOL. 111
OCEANOGRAPHIC OBSERVATIONS AT OCEAN
STATION P, 8 AUG-23 SEPT 1980

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